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PERSONNEL AND
READINESS

08 SEP 2004

The Honorable Duncan Hunter
Chairman, Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The committee report on H.R. 4205 (H. Rpt. 106-616), page 372, National Defense Authorization Act for Fiscal Year 2001, directed the Secretary of Defense to examine the growth of housing costs in areas where the local costs of housing are believed to be directly influenced by increases in the Basic Allowance for Housing rates. The Secretary was also required to report his findings and recommendations for correcting any problem to the Senate and House Committees on Armed Services for the years 2001 through 2006.

The Center for Naval Analyses (CNA) conducted an extensive analysis of this issue and the Secretary reported the findings in September 2003. A copy of that report is enclosed. CNA found that the increases in military housing allowances had a small effect on local rental markets. In Oahu, one of the markets that was examined, CNA concluded, "the combination of a small increase in demand and a long-run increase in supply suggests that the overall effect on market rents would be small." CNA also studied the Fort Campbell, Kentucky, housing market, which has an even greater representation of military personnel. Because of the relative size of the military in this area, there was the possibility that an increase in the housing allowance could have a larger effect on local rental costs. CNA found this not to be the case.

Based upon CNA's thorough investigation over a multi-year timeframe and the findings that there has been no evidence of a substantial impact, the Department does not believe that further reports would be useful. We have discussed our views with the Committee staff. A similar letter has been sent to the Chairman, Senate Committee on Armed Services.

Sincerely,

Charles S. Abell
Principal Deputy

cc:
The Honorable Ike Skelton
Ranking Member

Enclosure:
As stated

Report to Congress

Effects of Basic Allowance for Housing on Local Housing Markets

September 2003

Approved for distribution:

May 2002

Alan J. Marcus, Director
Infrastructure and ReadinessTeam
Resource Analysis Division

This document represents the best opinion of CNA at the time of issue.
It does not necessarily represent the opinion of the Department of the Navy.

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Contents

Summary

There has been concern that an increase in the military housing allowance will cause rents to rise in the private sector. If true, the benefits to servicemembers of increasing allowances would be eroded and civilian renters would be hurt. This paper examines how increasing housing allowances are likely to affect the rental housing market. We begin by reviewing the history of military housing allowances since 1982. Next, we survey the economics literature on housing allowances and discuss the conditions that might cause allowances to affect rents. We then examine the effect of past allowances on rents in Oahu, Hawaii, and Clarksville, Tennessee, near Fort Campbell. The analysis presents data on rents and several factors that might influence rents. We use econometric analysis to assess the magnitude of the impact of allowances on rents.

An increase in the current allowance would likely have a small effect on rental prices in Oahu

The effect of increases in military housing allowances on local rental markets has been small. While any increase in money available to consumers will likely increase demand for housing services, the magnitude of the increase stemming from increasing the allowance is likely to be small compared to other influences in the housing market. The effect of the allowance also depends on how much of the market receives the allowance. Thus, the overall effect in Oahu is likely to be small, but in a few localized areas, the effect may be noticeable.

Conditions in Oahu suggest that effects are likely to be small

The effect of an allowance increase will be determined by how much it increases demand for rental housing and how the supply of rental housing responds to any shift in demand. If the demand shift is small,

or the supply response is to expand to meet higher demand, there should be little effect on market rents.

Increasing the housing allowance in Oahu to eliminate the out-of-pocket expenditures—a relatively large increase compared to past increases—would likely have only a small effect on demand. The current housing allowance is not tied to housing expenditures, so it is essentially an increase in income. Evidence that only a small share of an increase in income is devoted to increased housing consumption, that the magnitude of the increase relative to total income is small, and that servicemembers constitute a limited share of the market suggests that demand increases from an allowance increase will be small.

The ability of the housing market to respond to increased demand suggests that, in the long run, supply would expand to meet higher demand. Some effects might occur in the short run, but the growth in the housing stock that has occurred in the past and is predicted to occur in the future suggests that the supply response would lessen the effects of a demand increase. Further, based on the landlord concentration ratios obtained from lease data, the housing market in Hawaii appears to be competitive, so that price competition by landlords is likely to hold down rent increases from an expansion of demand associated with an increased allowance.

The combination of a small increase in demand and a long-run increase in supply suggests that the overall effect on market rents would be small. However, there may be short-run effects before supply responds.

Data analysis indicates that allowances would have little effect on rents in Oahu

The military housing allowance is designed to reflect market prices, so the correlation between prices and allowances will be high. However, the history of rents and allowances shows that there are movements in rents that do not appear to have corresponding changes in the allowances. Further, when we compare the history of rents in areas with a high concentration of military renters—where allowances are most likely to influence rents—with the history of rents in

areas with a low concentration of military rents, we find no appreciable differences. In the late 1990s, for example, rents fell in both types of areas while allowances remained steady.

This intuition is supported by regression analysis using advertised rental rates. First, using the rents in areas of Oahu with a small concentration of military personnel as a proxy for macroeconomic influences on the rental market and additional controls such as income and unemployment indicates that housing allowances do not affect rents in areas with a high concentration of military personnel. However, defining the market very specifically indicates that there may be very localized effects of the allowance. Second, estimation of a simultaneous equations model of Oahu and a corresponding reduced form model indicates that the income elasticities of demand and rent are small enough to ensure that increases in the allowance do not provide a major shock to the housing market in Oahu.

An increase in the current allowance would likely have little effect on rental prices near Fort Campbell

Fort Campbell, Kentucky, is a large military base located in an urban setting that is considerably smaller than Oahu. Though the relative size of the military in the local area creates the possibility that an increase in the housing allowance could have a larger effect on the local rental market, this does not appear to be the case. One possible reason that military housing allowances have not influenced rents in Clarksville, Tennessee—the major city adjacent to Fort Campbell—is that the supply of rental housing has grown significantly since 1990. This supply response mitigates increases in demand that might stem from higher allowances and increased local area population.

Estimates of the effects of allowances on areas in Clarksville with a higher concentration of military renters indicate that the allowance is not likely to drive rents, though econometric issues suggest interpreting the results with caution. To obtain these estimates, we controlled for macroeconomic variables and used rents in Clarksville areas with a lower concentration of military renters as a proxy for unobserved influences.

Previous allowances may have had different effects

The conclusion that recent allowance changes have not strongly influenced local rents is based on post 1990 data. The allowance system used between 1982 and 1998 in the continental United States and from 1986 to 1998 in Hawaii provided for a partial reduction in allowance if the servicemember used less than the maximum. However, from 1982 to 1986, allowances in Hawaii were tied to actual expenditures—if a servicemember elected to rent housing costing less than the maximum allowance, the servicemember's allowance was reduced dollar for dollar. This provides very different incentives for consumption and possibly higher demand effects from an increase—and creates a stronger link between military housing allowances and local market rents. However, data from 1982 to 1986 were not available for this study. Further, the effect of the allowance increases as the share of the market receiving that allowance grows.

Introduction

An allowance for housing has been a major component of military compensation for all personnel since the Career Compensation Act of 1949 extended housing entitlements to all enlisted ranks [1]. Currently, about two-thirds of military personnel receive housing allowances and live in private-sector housing. In FY 2002, the budget for housing allowances is almost $7.5 billion. However, there has been concern that an increase in the housing allowance will cause rents to rise in the private sector. If true, increasing allowances would provide no benefit to servicemembers and would hurt civilian renters.

This paper evaluates the effects of military housing allowances on rental market prices. The focus of this paper is on the Oahu, Hawaii, housing market because its geographic configuration, large military presence, and historical allowance systems may create conditions where allowances might have a strong impact on rents. This paper discusses the conditions that must exist if allowances are to affect rental markets and whether those conditions exist on Oahu. It also presents analyses of data on the Oahu housing market.

In addition, we studied the housing market near Fort Campbell, Kentucky. We chose this location because the number of military personnel at the installations is large relative to the local populations.

One complication when dealing with housing and housing prices is that every house is a unique combination of location, space, condition, and amenities. The difference in prices could reflect these differences. The rental price should be thought of as a price for a given level of housing services, which incorporates all these features of the dwelling. Thus, there is a distinction between housing prices and housing expenditures. An increase in housing price means that the cost for the given level of services has risen, but an increase in housing expenditures could arise from consuming more services or from an increase in prices.

A second complication in examining the relationship between rents and allowances is that allowances are set to reflect rents. Thus, when rents rise, allowances should rise accordingly. This makes it difficult to determine causality. Do market rents drive allowances, do allowances drive market rents, or do the two reinforce each other? This paper presents the data and alternative analytical approaches to determine the effects of allowances on market rents.

The paper begins with background information on the different ways that housing allowances have been determined since 1982 and the incentives created by the different approaches. We follow this with a brief review of some pertinent economics literature on rental markets. Next, we discuss the conditions that must, theoretically, be in place before an increase in the allowance will affect rental markets.

Following this general discussion, we provide an analysis of the Oahu rental market, consisting of a description of the market, data on rents and allowances, and econometric analysis of the rental market. Brief analyses of the Fort Campbell rental markets follow.

Housing allowances

The military has been providing housing allowances based on local rental costs since 1981. The way that these allowances are determined changed significantly in 1998. In addition, in the early 1980s, allowances in Alaska and Hawaii were provided on a different basis than the allowances in the rest of the United States. Each system created different incentives for individual housing consumption. In this section, we describe the allowances, and how they should affect consumer behavior.

Allowance determination and payments

Basic Allowance for Housing (1998 to present)

The current allowance system, which was implemented in 1998, is called the Basic Allowance for Housing (BAH). BAH rates are designed to be equitable across geographic locations. This means that servicemembers of a given grade and dependency status who rent the typical housing for their grade in their local housing market will have the same out-of-pocket costs in all locations. To keep out-of-pocket expenses equivalent, BAH rates will be higher in areas with higher housing costs.

BAH rates are based on the median rental price for a housing standard established for each paygrade and dependency status. The median rental prices are determined by market surveys for housing that meets acceptability criteria. These criteria include:

- Commuting distance and time
- Neighborhood acceptability for military personnel
- Comparable military and civilian incomes in the neighborhood. Surveys are focused on neighborhoods where the typical civilian income is in the same range as the incomes of the

servicemembers whose paygrades correspond to the housing standard being surveyed in that neighborhood.

The allowance for each paygrade is then set to cover all but a fixed dollar amount of the median housing costs of the housing standard for that paygrade in that market.[1] The fixed dollar amount that is not covered, the out-of-pocket cost, is a set percentage of the national median standard housing cost for that paygrade. In 2001, the out-of-pocket cost was 15 percent. In 2000, DoD proposed phasing this percentage down to zero by 2005.

Keep in mind that BAH is paid to the servicemember regardless of the actual rent paid. If a servicemember elects to live in smaller or lower quality housing and thus pays rent that is lower than the median, the servicemember can use the difference between actual rent and BAH for any other purpose. Because of this, BAH has the same effect as increasing income for servicemembers who live in civilian housing.[2]

Basic Allowance for Quarters and Variable Housing Allowance

BAH replaced the Basic Allowance for Quarters and Variable Housing Allowance (BAQ/VHA) system. BAQ/VHA was authorized in 1980 and became an entitlement in 1981, except in Hawaii and Alaska, where it was implemented in 1986. This allowance consisted of a rank-based BAQ that was constant across geographic areas, and a rank-and-location-specific VHA. The VHA supplemented the BAQ to reflect the housing costs in the local markets.

Though BAQ/VHA, like BAH, was intended to cover all but a certain dollar amount of national median housing costs, it used a very different process of determining local housing costs. Rather than using market surveys, housing costs were determined by surveys of service-

1. Housing costs are defined as rent, average utilities, and renters' insurance.

2. The increased income is actually more than increased pay because the allowance is tax-exempt.

members' actual expenditures. In some cases, this led to allowances that did not reflect the local housing costs.

If the allowance was inaccurately established, BAQ/VHA's allowance-setting process would reinforce and exacerbate the error. If the allowance was too low, some servicemembers might elect to reduce housing expenditures by living in housing that was smaller or of lower quality than the intended standard. Because the subsequent allowance was based on what servicemembers were actually paying, annual revisions of BAQ/VHA rates would incorporate this low-cost (and low-quality) housing into the revised allowance, which sometimes led to a greater divergence between market costs for the standard housing and the allowance. As the allowance fell behind housing costs, even more servicemembers might choose below median housing, leading to a cycle that reinforced the unintended low allowance. The opposite effect could occur if the allowance was initially too high: The surveys would reflect expenditures on above standard housing as the market rent, and the VHA would provide overly generous allowances. These distortions could vary by market, or by rank, as the VHA varied by rank and market. This problem could be especially acute in areas with rapidly rising housing costs, because the allowance was based on information that was outdated by the time it was implemented.

By basing the allowance on a survey of the market rents for a housing standard rather than a survey of housing expenditures, BAH was designed to correct this problem.

A second difference between BAH and BAQ/VHA is that VHA reduced the allowance to servicemembers who chose to spend less than the maximum allowance. Any portion of the VHA that was not used resulted in a 50-percent offset of the unused allowance. That is, the servicemember would receive only half of the difference between the maximum allowance and the actual housing cost. This made the price to the servicemember of consuming an additional $1 of housing only 50 cents, up to the maximum allowance. BAH eliminated the offset by paying the full allowance regardless of actual housing costs.

Rent Plus (Alaska and Hawaii only, 1982 to 1985)

In Alaska and Hawaii, which had traditionally been considered overseas locations for housing allowance purposes, a "Rent Plus" program was in effect from 1982 through most of 1985. The Rent Plus program reimbursed servicemembers for actual costs up to a designated ceiling for each paygrade, and provided an additional allowance for utilities. The ceiling was set at the 80th percentile of local housing costs, so that 80 percent of servicemembers would be reimbursed fully, and the remaining 20 percent would be reimbursed at the ceiling [2].

The Rent Plus reimbursement rule was effectively a 100-percent offset. Any servicemember who chose to spend less than the allowance ceiling would forego the entire difference between the ceiling and actual expenditures.

Theoretical effects of allowances on housing markets

BAH

As stated earlier, BAH acts as additional income to the servicemember, because the amount of the allowance is not determined by the expenditures on housing. Theoretically then, the effect of BAH on the decision of housing consumption is the "income" effect. This effect is that people generally increase their consumption of goods and services as their income increases. Thus, with more income, servicemembers would be expected to spend some of this increased money on larger dwellings or dwellings that offered more amenities or a better location.

Because the money is the servicemember's to choose to spend on housing or other items, he has the incentive to search and bargain with landlords for the best housing value he can obtain. Further, the servicemember will respond to price increases by substituting consumption of other goods for housing. This limits the landlords' bargaining power.

Rent Plus

Rent Plus was the opposite of BAH. The amount of the allowance in the Rent Plus program equaled actual expenditures, up to the maximum. If a servicemember chose to live in housing costing less than the maximum allowance, he would forego any additional benefits from spending more on housing. Assuming that better housing is always preferable, the servicemember thus had an incentive to elect housing that cost about the maximum.

This does not mean that the servicemember would willingly pay the maximum allowance for any housing, because the servicemember would then be foregoing the opportunity to live in a better dwelling. Thus, the servicemembers would still be willing to search for a good value and bargain with landlords for improvements to the dwelling.

However, because the cost to the servicemember is only foregone improvements in housing services rather than any other possible goods, the servicemember might find the costs of additional searching and bargaining higher than the expected benefits of better housing. Further, the servicemember might be much more willing to bid higher for the rent for a given house, because the only trade-off is between houses rather than between housing and any other good. Together, these two factors can increase the servicemember's willingness to pay for a given level of housing.

In a worst case scenario, the landlord and the tenant could collude to raise the rent, with a kickback promised to the tenant. This would increase the cost of housing without improving housing, but would allow the servicemember to convert the housing allowance to purchases of other goods. Such arrangements would not impose additional improvement costs on landlords, though there would be legal ramifications if they prosecuted for fraud.

Thus, landlords might accept higher vacancy rates if they had a good chance of renting to servicemembers with a higher willingness-to-pay or who would agree to a kickback scheme. This could give landlords additional bargaining power over non-military renters, possibly enabling the landlords to extract higher rents. This could drive up market rental prices.

The combined effect is that the Rent Plus allowance system could have a larger impact on the market than an allowance such as the BAH, which has the same ceiling but is not tied to consumption.

The extent to which Rent Plus affected the market was also limited by the number of servicemembers who would have rented at or above the maximum even if the allowance was not conditional on expenditures. For these people, the allowance provided no additional incentive effects for increased consumption. A 1986 General Accounting Office (GAO) report indicates that by 1985, over 70 percent of the enlisted personnel and 80 percent of the officers in the Honolulu area were over the cap, which had not changed since August 1983. (The report does not specify how many of the remaining personnel were at or just below the cap, and how many were well below the cap.) These data suggest that by the end of the program, the distortions may not have been significant.

BAQ/VHA

BAQ/VHA allowances were tied to housing expenditures, but rather than a complete offset in allowances for expenditures less than the maximum, the offset was only 50 percent. Thus, we could expect to see the same types of effects as with the Rent Plus program, only to a lesser degree. But now, the servicemember could decide not only between different units of housing but also between particular housing and the purchase of non-housing goods. The offset meant that for every dollar less spent on housing, he could consume one-half a dollar in other goods. Thus, there is still the incentive to consume housing up to the maximum allowance, but that incentive is weaker.[3]

The effects on search, bargaining, and possible landlord/tenant side agreements are all smaller, but they still exist with the BAQ/VHA. Consequently, the potential market effects still exist, just to a lesser degree. As with Rent Plus, only the people who would otherwise choose to spend less than the maximum allowance on housing contribute to these market effects.

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3. The effects of the subsidies are further discussed in [3].

Literature on rental housing markets

Housing Assistance Supply Experiment

Starting in 1974, the U.S. Department of Housing and Urban Development funded a 10-year allowance program in Brown County, Wisconsin, which includes the Green Bay housing market, and St. Joseph County, Indiana, which includes the South Bend housing market. The primary purpose of the study was to determine how a large-scale allowance program would affect housing markets. The study concluded that the effect on housing prices was small. In this section, we briefly describe the experiment and discuss how the findings may apply to the Oahu housing market [4, 5].

Description of experiment

Under this experiment, a substantial allowance was offered to a large segment of the market. The entitlement was equal to the standard cost of adequate housing in the market, less 25 percent of the household income. This limited the subsidy to those households whose income was four times the cost of housing. The allowance was available to both renters and homeowners, and was independent of actual expenditures. Participants' housing had to meet acceptability standards. The typical allowance received was half of housing expenses and 25 percent of the household income. To limit the shock to the market, program enrollment was built up over two years. About 20 percent of households were eligible, but only about 8 percent were enrolled and 7 percent received payments at any one time. (People who would receive very small payments were most likely to elect not to participate.) The study evaluated the effects of the subsidy initially and after 5 years. The 5-year evaluation provided a reasonable assessment of the program once it had matured, and because the program was to continue for some time into the future, there were no end-of-program effects to distort the evaluation results.

The markets were selected to provide two different environments. Both markets included an urban core and suburban or rural outer areas. The Brown County/Green Bay market bears some resemblance to the Oahu market. The site was selected because it was a "tight" market, with a vacancy rate of 5.1 percent; between 1994 and 2000, the vacancy rate in Honolulu fluctuated between 4.7 percent and 7.9 percent.

Experiment findings

The researchers used administrative records on income and rent and survey data on rental property characteristics, revenues, and expenses to compile a time-series data set of dwellings and property. The key conclusions were:

- Controlling for dwelling characteristics, the allowance had a "pure participation effect" of increasing participants' rents by 1.4 percent in Brown County and 2.1 percent in St. Joseph County. From 6 months before the program started enrolling renters to late in the first program year, participants' rents rose about 3 percent more than nonparticipants' rents, but the difference diminished over time.
- Contract rents rose 5.6 percent annually in Brown County and 4.4 percent annually in St. Joseph County. In the north-central region where the two counties are located, rents rose 5.2 percent annually.
- Operating expenses for landlords rose faster than rents, suggesting that at least some of the increase in rents was due to higher costs. The rent changes were higher for those dwellings that required repair to meet the program's acceptable housing standard.
- Few landlords raised rents when their tenants entered the allowance program, even though a new one-year lease was required.
- Renters allocated 84 percent of their allowance to additional consumption of non-housing goods, and only 16 percent to additional housing consumption. Housing consumption

increases were much higher among those who moved than those who did not.

- The amount of housing stock rose in response to the increased demand. At the end of 5 years, the supply response had closed two-thirds of the gap between supply and demand in the tight market in Brown County, and 80 percent of the gap in the loose market in St. Joseph County.
- The was no evidence of market-wide price effects on rents that could be attributed to the program.

Implications for allowances

This experiment suggests that the military housing allowances are likely to have a negligible effect on housing markets. Although the experiment affected only lower-income people, the participation rate in the lower-income housing market was relatively high. Among the 20 percent of the market that met the income eligibility requirement, 40 percent were enrolled. Thus, a relatively large share of the lower-income market was receiving a subsidy, which could, theoretically, have a significant effect on the lower-income rental market. However, the participation effect was only 1.4 and 2.1 percent in the two counties, and, moreover, there were no market-wide price effects.

In Hawaii, the effects might be more muted because the military housing allowances are spread over a broad income range. Unless there are unusual circumstances in a local market, the finding that allowances did not significantly increase rents is likely to apply to other local markets.

Determinants of market rents

Relevant literature

Economists have studied the factors that affect market rents, specifically how prices and income affect demand, and how supply responds. Several studies have found that the demand for housing services rises with income. A 1998 paper by Hansen, Formby and Smith [6] reports that income elasticities vary from .14 for renters in

the lowest income decile up to .47 for those in the highest income decile, with a mean of .35. This means that, on average, an income increase of 1 percent will lead to a .35-percent increase in housing consumption. A 1996 survey article by Jud, Benjamin, and Sirmans reports elasticity estimates of .2 to .3 for measured income, and .4 to .5 for permanent income [7].

Other studies have estimated how housing demand falls with higher housing prices. A study based on data from the Housing Allowance Demand Experiment found elasticities of -.19 to -.63 for lower-income households [8]. Another study of a broader sample of households found price elasticities from -.46 to -.54 [7].

Studies of housing supply responses to higher rents have found that the supply expands as prices rise. A 1996 survey article reports estimates of the elasticity of supply with respect to rent range from .3 to 2.2 [7]. Bernstein and Tolley estimate that the short-run elasticity of supply is .64 in 53 counties with on-base naval housing and .284 in Honolulu County [9].[4]

Several studies have examined the relationship between vacancy rates and rents. The consensus is that rents and vacancy rates are negatively correlated. One study found that advertising rates were also closely associated with rent changes [7].

Researchers have also examined length-of-residency discounts. There exists some, but not overwhelming, evidence of discounts for long-term tenants [7]. That is, tenants who renew their leases—or tenants who sign long-term leases—may be able to negotiate lower rents. This may be because the landlord can avoid the expenses associated with finding new tenants, such as vacancy, advertising, and refurbishment.

A recent study examined how the elimination of naval housing would affect housing markets. Moving naval housing residents to the private market could provide a significant shock to the housing market. The study estimated that the short-run shock in Honolulu would increase

4. Honolulu County is the island of Oahu, which is also the Honolulu Metropolitan Statistical Area (MSA).

demand by 4.24 percent and cause a short-run increase in rents of 5.4 percent, which would decline over time [9].

Implications for rents and allowances

The studies have implications for how housing allowances might affect the market:

- First, the finding that there is a positive income elasticity of demand suggests that any allowance that provides income will have some effect on the demand of those individuals. How this translates to a market effect will depend on the magnitude of the income increase and the proportion of the population that receives the benefits.
- Second, the finding that tenants have a negative price elasticity of demand suggests that tenants respond to price increases by consuming fewer housing services. This may translate into limitations on landlords' ability to increase prices after an increase in the allowance.
- Third, the positive price elasticity of supply indicates that higher prices lead to more rental housing. This could have a feedback effect of lowering long-run prices if allowances create a short-run increase in demand and rents.
- Fourth, the negative correlation between vacancy rates and rental prices suggests that competition for tenants is a factor in the rental market. This may limit landlords' ability to raise rents after an increase in housing allowances.
- Fifth, length-of-residency discounts might result in higher prices for military personnel, who are more likely to move and are thus less able to take advantage of these discounts, even if offered. Further, landlords might be less willing to offer length-of-residency discounts. One possible reason is that servicemembers may be likely to move even after receiving the discount, and thus the landowners incur the costs of finding new tenants anyway. A second possible reason is that a landlord might feel less pressure to offer the discount. Servicemembers might accept rent increases because the costs of moving are high

compared to the benefits of a lower rent over the expected tenure at a new location if the servicemember moved in response to a high increase.

Conditions necessary for allowances to affect rent

The market price of any product is a function of both the demand and supply for that product. For the allowance to affect market rental prices, it must operate through supply and demand. In this section, we will discuss how supply and demand could change due to an allowance increase.

Demand conditions necessary for allowance to affect rents

BAH increases individual consumer incomes. Income increases are likely to lead to higher demand for most goods, including housing. Some people who receive the additional income will want to use a portion of that income to buy more housing. The positive income elasticities found in empirical studies support this conjecture. The aggregate effect of a number of individuals who desire more housing is an increase in demand. For the allowance to affect market demand, this shift must be significant relative to the market. A "large" effect relative to the market as a whole must result from a combination of several features:

- The allowance increase must be large.
- The portion of the allowance increase that individuals devote to additional housing must be large.
- The share of the renter market receiving the allowance increase must be large.

It is not necessary that all of these be large, but that the combination be large. For example, suppose that the allowance is relatively modest, but that the entire renting population receives the allowance, and everyone receiving the allowance devotes the entire allowance to housing. Then it is conceivable that the aggregate demand would

increase significantly. However, even a large allowance can have a small impact if it is given to only a few people in the market, or if everyone receiving the allowance uses it to purchase other goods. The combination of these factors will determine how far the demand for rental housing shifts as a result of the allowance.

Supply conditions necessary for allowance to affect rents

The supply response to an increase in housing demand will affect prices. In order for increased demand for rental units to lead to higher rents, the supply must be restricted from expanding to meet this increased demand, or suppliers must cooperate to elevate rents above the level that would result from competition.

The ability of the supply to respond to housing demand varies over time. Initially, higher demand can be met by the "slack" in the supply represented by vacancies. If rental properties of the desired quality are available, they might be able to meet the increased demand. Other short-run responses can include conversion of owner-occupied housing to rental housing, or a faster turnover of rental housing undergoing refurbishment. However, in the short-run, it is unlikely that additional housing can be built to meet the increased demand.

In the long-run, additional housing can be built, and such an expansion would lead to lower prices for housing. This would happen if higher demand increases rents so that potential landlords expect a return on an investment in rental housing that exceeds other opportunities. We would expect this expansion to occur unless there are constraints that prevent additional housing from being built. These constraints could be zoning restrictions, geographic constraints, the withholding of potential development sites, or a lack of financing for additional building.

Working together, landlords might be able to sustain rents above the competitive market, charging a price closer to the maximum that the consumer is willing to pay for a rental house than to the price that would prevail if landlords competed. These higher rents would lead to lower consumption, so for the higher rents to be sustained, they must exceed the cost of higher vacancies. Further, individual

landlords would have to be unwilling to offer slightly lower rents to reduce their vacancies. Such price cutting would induce competition that would eliminate the uncompetitive rents. Economists have found that the larger the number of participants to coordinate, the harder it is to maintain prices higher than the competitive level [10]. Thus, for this type of collusion to succeed, a relatively small number of landlords would need to control most of the market.

Allowances and the Oahu rental market

Oahu demographics and market description

Geography

Geography dictates some aspects of Oahu's housing markets. Because Oahu is an island, there are limits on the availability of land on which to build houses, and on opportunities to commute from nearby localities. The two mountain ranges that occupy a significant part of the island are unsuitable for development and are mostly zoned for conservation. Further, parts of the island are reserved for agricultural or military use [11]. However, some areas are still available for development. Conservation land is unlikely to be rezoned, but it is possible to rezone agricultural land. Tables 1 and 2 show the zoning and use of land in Oahu. These restrictions have led to the development pattern shown in figure 1. Military areas are shaded dark; urban areas are shaded lightly. Servicemembers tend to live in areas near their duty stations, so the areas around Schofield Barracks, Pearl Harbor, and Kaneohe have higher military concentrations.

Table 1. Classification of land use in Oahu, 2000[a]

Classification	Acreage
Urban	99,686
Conservation	156,618
Agricultural	129,884

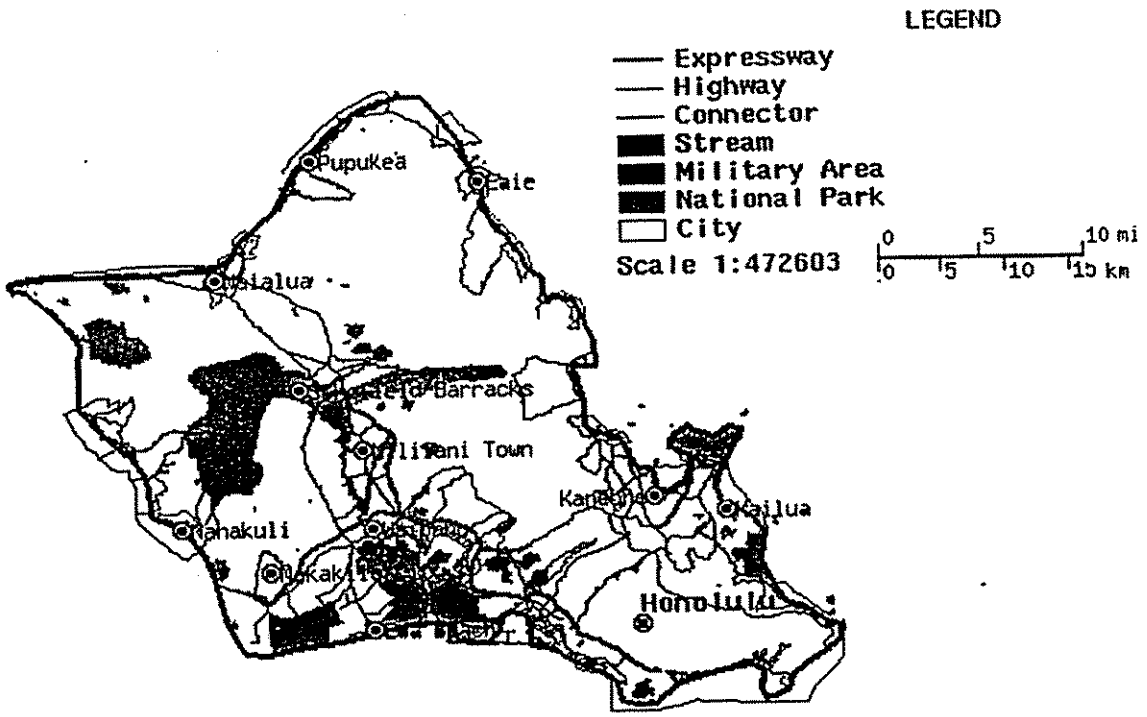
a. Source: *State of Hawaii Data Book 2000*, table 6.04.

Table 2. Oahu land use, 1998[a]

Existing use	Acreage	Percent
Residential	32,110	8.6
Industrial	9,571	2.6
Commercial	4,277	1.1
Hotel	315	0.1
Agriculture	56,954	15.2
Usable vacant	48,084	12.8
Other	223,559	59.6

a. Source: *State of Hawaii Data Book 2000*, table 6.02.

Figure 1. Oahu map (based on 1990 census)[a]

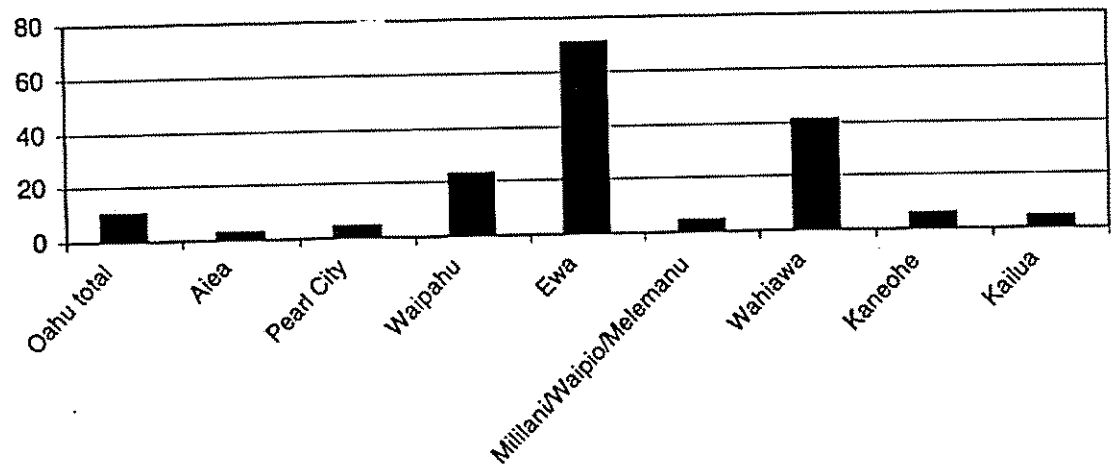


a. Source: Census Bureau, TIGER/Line mapping service, http://www.census.gov/geo/www/tiger/index.html, accessed 11/27/2001. The data used to generate this map are from the 1990 Census. Some military areas have been closed and converted to private use, for example, NAS Barbers Point in the southwestern corner of the island.

Housing units

Despite the land use restrictions, the housing stock has expanded since 1990. Figure 2 shows the growth in housing stock on Oahu as a whole and in neighborhoods near military installations. Between 1990 and 1998, the housing stock grew by more than 30,000 units—more than a 10-percent increase. Almost two-thirds of the growth was in Ewa, the former site of Naval Air Station Barbers Point. However, even relatively built-up areas such as Pearl City experienced growth.

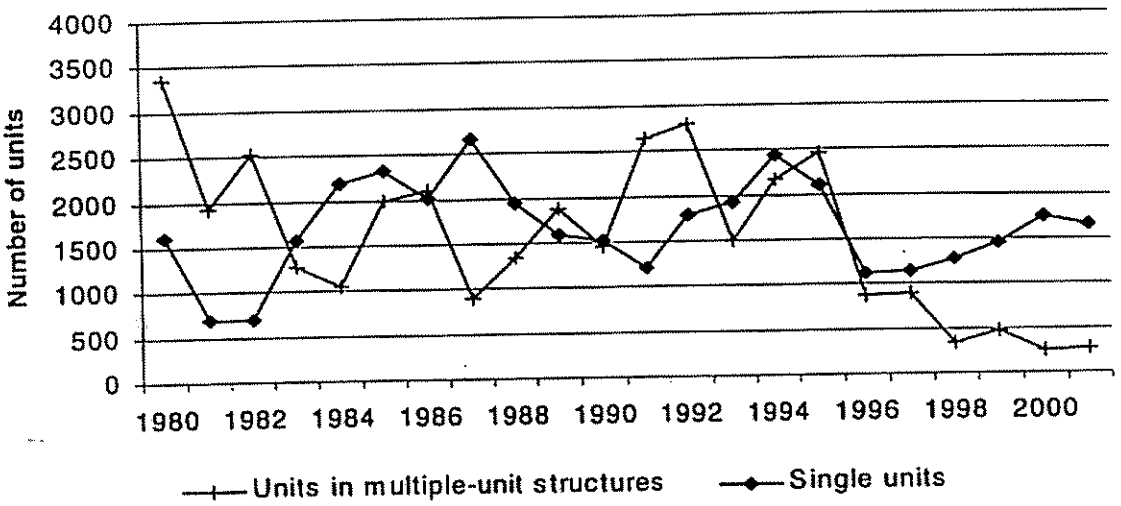
Figure 2. Percent change in housing units, Oahu and selected neighborhoods, 1990 to 1998[a]



a. Source: *State of Hawaii Data Book, 2000*, table 21.16.

Permits for new housing units also indicate that housing stock in Oahu has grown. Figure 3 shows the annual number of units authorized by building permits issued in Honolulu County between 1980 and 2001. The units in multiple-unit structures include both condominiums and owner-occupied townhouses, so the figures do not translate directly into the number of new rental housing units. These data indicate that there was a significant amount of construction in the early 1990s, but that the pace of construction slowed in the late 1990s. This pattern corresponds to falling rental rates in the late 1990s.

Figure 3. Housing units authorized by building permits in Honolulu County, by single and multiple unit structures[a]



a. Source: Census Bureau.

Rental housing stock in Oahu has also been expanding, as shown in table 3. The renter-occupied and vacant units for rent rose by 6 percent between the 1990 Census and the 2000 Census. The 2000 Family Housing Market Analysis projected 5-percent growth in rental housing stock between 2000 and 2005 [12]. Population growth from 1990 to 2000 was 4.5 percent.

Table 3. Renter-occupied units and vacant units for rent[a]

Year	Units
1990	132,872
2000	141,354

a. Source: Census Bureau.

A significant portion of military families live in government housing. In 1996, there were 20,071 government family housing units [13]. In 2000, there were 19,587 units [12]. The supply of military family housing has been fairly constant since 1980, though the quality has improved as newer units have replaced older units.

In Hawaii, about 25 percent of the land is held by a few large landowners [11]. In some cases, rather than sell the land outright, a landowner will let, through a long-term (usually 55 years or more) ground lease, the use of the land. The lessee buys the right to build on the land [14]. In Oahu, about 7 percent of homeowners were on leasehold land in 2000 [11]. Some argue that this arrangement, and the terms of the leases, increase rental prices, as tenants ultimately bear the cost of high ground leases.[5] This paper does not examine the effects of leaseholding on residential rents. The data available do not include information on whether the rental property is held in fee simple or leaseholding, so we are unable to determine the effects on rents.

Population

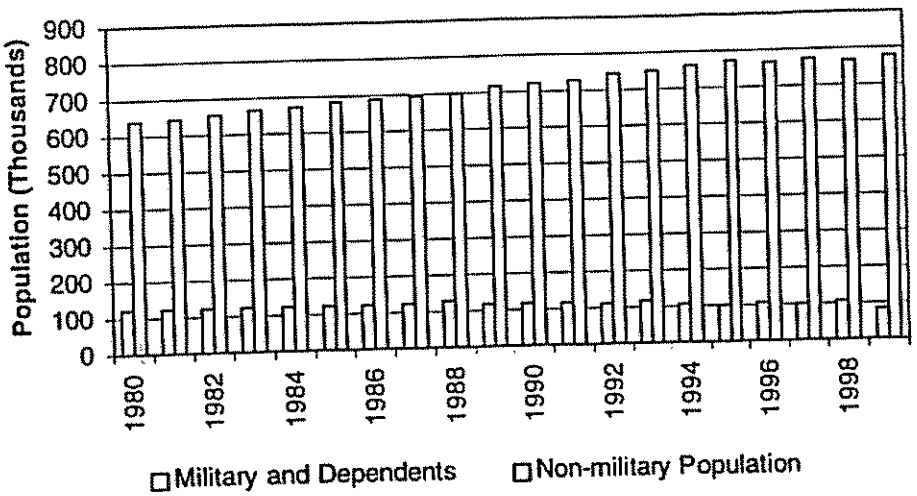
Population can influence housing demand. The non-military population of Oahu has been growing slowly over time, whereas the number of military and dependents has fallen recently, as shown in figure 4. Between 1980 and 1999, the military and dependent population fell by about 30 percent; from 1989 to 1999, it fell by almost 20,000, or 19 percent. In 1999, military personnel and their families constituted about 10 percent of the Oahu population. A declining share of the population and a steady inventory of military housing suggest that the military has less influence on the housing market today than it had in the past.

Income

Median income is also a major factor in housing markets. In Hawaii, the real median income fell from the mid to the late 1990s, increasing only at the end of the decade, as shown in figure 5. This is in contrast to the rising real incomes in the mid to late 1980s and, following a dip in 1988–1989, an increase again during the early 1990s. The housing market literature has found that higher incomes are associated with higher housing prices.

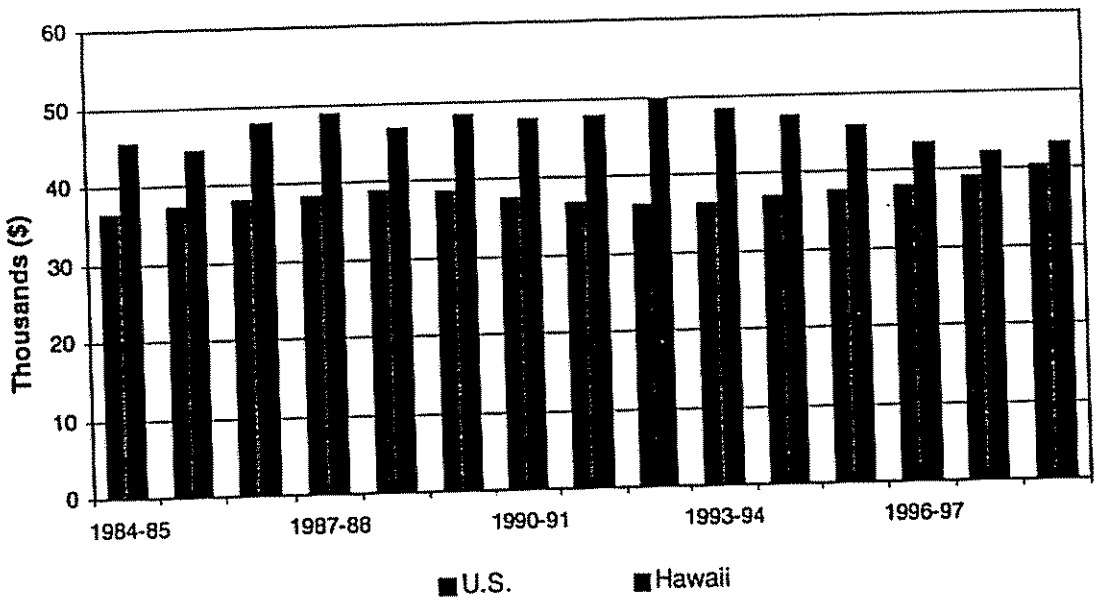
5. See Hawaii SB255, introduced to the Hawaii Senate on January 19, 2001, for a discussion of these arguments.

Figure 4. Oahu military and dependent, and non-military population[a]



a. Source: *State of Hawaii Data Book*, table 10.04 (military and dependents) and Census Bureau.

Figure 5. Median household income, in constant 1999 dollars[a]

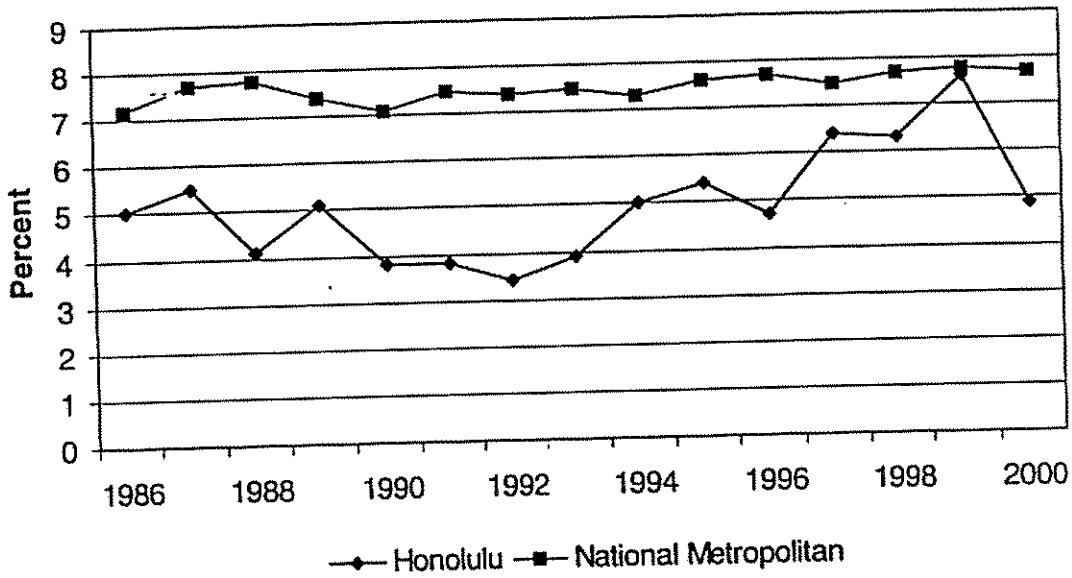


a. Source: *State of Hawaii Data Book 2000*, table 13-12.Two-year moving average used for median income.

Vacancy rate

The vacancy rate represents the difference between housing supply and housing demand at the current market rents. Markets with higher vacancy rates might be able to absorb increases in demand without significant price increases. Historically, Honolulu has had a vacancy rate that was a little lower than the national average, but in the mid to late 1990s, it increased, as shown in figure 6.

Figure 6. Vacancy rates[a]



a. Source: Census Bureau.

The Oahu market and the conditions necessary for allowances to affect rents

As discussed earlier, the allowance might affect market rental prices by changing demand, supply, or both. In this section, we will discuss how demand and supply in Oahu could change due to an allowance increase.

Demand effects

As stated earlier, a "large" demand effect in the market as a whole must result from a combination of several features:

- The allowance increase must be large.
- The portion of the allowance increase that individuals devote to additional housing must be large.
- The share of the renter market receiving the allowance increase must be large.

Size of an allowance increase

The size of the allowance increase can vary. As a hypothetical example, consider increasing the BAH to eliminate out-of-pocket expenditures, a relatively large increase.[6] Because BAH is not tied to expenditures, it is equivalent to an increase in income. In Hawaii, this translates into a relatively small increase in income, ranging from about 4 percent at the lowest paygrades to 2 percent at the highest paygrades. (Table 4 lists the income increases for selected paygrades.) Thus, a relatively large housing allowance increase constitutes a relatively modest income increase.

Amount of allowance increase allocated to increased housing

The effect of increasing allowances will be dampened because income increases are not devoted solely to increased housing consumption. The Housing Allowance Supply Experiment found that only 17 percent of the allowance was spent on increased consumption of housing services. Hansen, Formby and Smith found that people with higher incomes spend a greater portion of increased income on housing, with a mean of .35. Applying their elasticity estimates to the change in income from a hypothetical BAH increase that eliminates the out-of-pocket expense indicates that the increase in housing

6. Eliminating the out-of-pocket expenditures would be about a 9-percent increase in the housing allowance for all paygrades in Hawaii. For example, since 1990, the largest percentage increases in allowances for E-5s have been 11 percent and 10 percent in 1991 and 1992, respectively. Since 1992, no E-5 increase has exceeded 7 percent.

consumption by E-5s receiving the allowance is likely to be small—about 1.1 percent—and lower at higher paygrades.[7]

Table 4. Monthly income increase from eliminating out-of-pocket costs in Oahu, selected paygrades (2002)

Grade (years of service)	BAH[a]	BAH + Basic pay + BAS ($)[b]	Out-of-pocket cost[c]	Percent increase from eliminating out-of-pocket cost	
				In BAH	In compensation
E-3 (2 yrs)	1,113.00	2,740.00	99.00	8.9%	3.6%
E-5 (6)	1,196.00	3,350.40	106.00	8.9%	3.2%
E-6 (8)	1,479.00	3,975.10	122.00	8.2%	3.1%
E-7 (12)	1,612.00	4,580.00	129.00	8.0%	2.8%
O-1 (1)	1,228.00	3,491.97	108.00	8.8%	3.1%
O-3 (6)	1,843.00	5,885.07	142.00	7.7%	2.4%
O-4 (10)	1,921.00	6,763.57	160.00	8.3%	2.4%

a. With dependents BAH is used.
b. BAS is Basic Allowance for Subsistence. For enlisted personnel, the Standard Rate of $241.60 is used. If rations in kind are not available, the BAS is $262.50.
c. The out-of-pocket cost is the absorption rate for personnel with dependents.

Further, this increase in housing expenditures might be devoted to increased housing consumption, rather than just to higher housing costs. This example suggests that housing allowance increases of the magnitude seen in recent history would have a small effect on housing demand and prices.[8]

This analysis is applicable to the BAH because the BAH is not dependent on expenditures. However, under the older allowance systems, which were tied to expenditures, the increases could be expected to be higher. For example, under Rent Plus, an increase in the allowance ceiling of 9 percent (the same as the percentage rise in the allowance considered above) could lead to a 9-percent increase in housing

7. These estimates of increased housing consumption imply that 11 to 14 percent of the increase would be spent on housing, which is similar to the findings in the Housing Allowance Supply Experiment.

8. There may be an additional effect of inducing some servicemembers to choose civilian rather than military housing. However, since the increase in income is relatively small, this would be expected to be small.

consumption by those servicemembers who are not over the cap. Because the income could not be spent on items other than housing, they might increase consumption by the entire amount of the allowance increase to receive the full benefits of the increase. Because money is fungible, an increase in the allowance would have an income effect only for those who spend more than the cap on housing.

Share of the market receiving the allowance increase

The share of the market that is affected by an increase in the military housing allowance should also be considered. In 2000, there were 142,363 rental properties in Oahu; 35,813 military personnel; and 23,034 military families. Thus, if every member of the military was in the rental market, the military would make up 25 percent of the market, and if every military family sought rental housing, they would together make up 16 percent of the market. However, a large percentage of the military personnel live in government quarters. In 2000, nearly 20,000 military housing units were available. Data from 1996 indicate that military personnel rented 8.6 percent of the private rentals [13]. Given the declines in the size of the military between 1996 and 2000 and the expansion of housing stock, the military housing allowance has probably affected only a modest share of the market.

To further consider the extent to which the allowance could affect local areas, we review the concentration of military in different housing areas. In 1996, the market with the highest share of military renters was Central Oahu, with only 25 percent military, as shown in table 5.

A relatively large increase in the housing allowance would not be expected to have a large impact on housing market demand. The effect would be dampened significantly because such an increase would constitute a relatively small increase in income and would be only partially spent on housing. Moreover, the military constitutes a relatively small share of the Oahu housing market.

Table 5. Military concentration in Oahu housing markets, 1996[a]

Market area	Military share (1996)
Honolulu	1.8%
Ewa/Leeward	15.5%
Pearl City/Aiea	14.0%
Windward	13.6%
Central Oahu	25.0%

a. Source: Oahu Military Housing Market Analysis, March 30, 1997.

Supply effects

As stated above, supply effects could result from restrictions on the ability of supply to expand to meet increased demand, or from suppliers cooperating to raise rents above the level that would result from competition.

Ability of supply to expand

The ability to expand housing to meet higher demand in Oahu is somewhat, but not completely, limited. The estimate of the short-run elasticity of supply in Bernstein and Tolley was a relatively low .284, which means that an increase in demand would not lead to a large short-run increase in supply and could lead to short-run price increases until housing supply expands.

However, as noted in figures 2 and 3, the supply of housing and rental housing has expanded and is expected to continue to expand. Further, there is a sizeable amount of usable vacant and agricultural land, as shown in tables 1 and 2. The rezoning of agricultural land would require regulatory action, but it is possible that high demand could prompt such action. Thus, it is likely, in the long run, that price increases would be minimal.

Landlord market power

The Oahu rental market consists of a very large number of landlords. Because of their numbers, they would have a hard time coordinating an effort to raise rents. A sample of 983 leases signed by military personnel from 1998 through 2001 shows 696 different landlords. The five largest landlords were responsible for 74 leases, or just

7.5 percent. In local areas, this percentage can go up because a landlord's holdings might be concentrated in those local areas. In two areas with a high concentration of military personnel, Pearl City and Millilani, the five largest landlords in the sample constitute just 13 and 12 percent, respectively. Although this is a very small sample, it appears that the landlord structure makes it unlikely that landlords could sustain prices that were not competitive.

Oahu allowance and rent data

HUD Fair Market Rent data

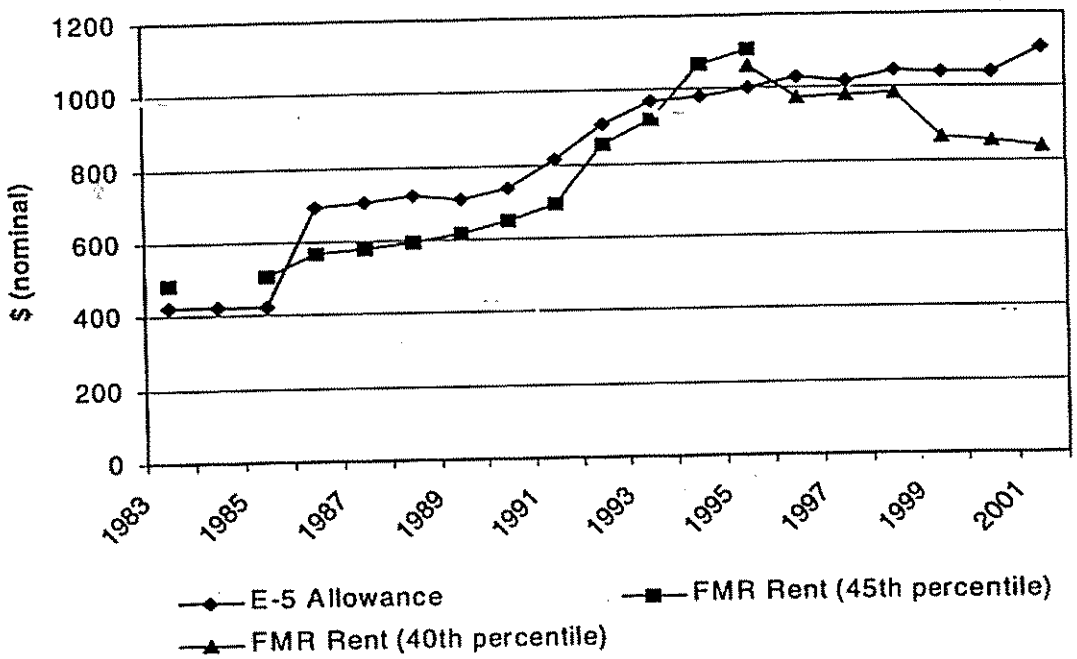
Preliminary analysis of data might suggest the relationship between housing allowances and market rents. One source of data on rental prices is HUD's Fair Market Rent (FMR) data, which estimates the market rent plus utilities (except telephone) for the 40th percentile of two-bedroom apartments. These data are collected as part of the Section 8 housing voucher program. HUD uses information from the U.S. Census, the American Housing Survey, and random-digit-dialing telephone surveys to determine market rents. The survey consists of households that have moved in the last 15 months, so the data reflect a moving average rather than the rent for properties currently on the market. Further, the FMR uses CPI data to project the survey data forward to the mid-point of the next fiscal year, when the data will be used in the Section 8 program.

Figure 7 presents both HUD's FMR and the E-5 allowance over time.[9] Because the allowance is designed to reflect the market rents, we would expect the allowance to grow somewhat like the FMR, particularly when the expected out-of-pocket percentage was intended to remain relatively constant. In 2001, the allowance was designed to decrease the out-of-pocket share to 15 percent, down from 19 percent of the national median housing cost in 2000. This would also increase the allowance relative to the market. The result is that the allowance remained fairly constant from 1998 to 2000, and then increased in

9. The E-5 housing standard for BAH computations is a two-bedroom townhouse or duplex.

2001, while the FMR declined. If the allowance had had a significant effect on market rental rates, as reflected in the FMR, the FMR would not have fallen.

Figure 7. HUD Fair Market Rent for Honolulu MSA and E-5 allowance[a]



a. HUD FMR was set at the 45th percentile of the market for two-bedroom apartments until 1995, when it was changed to the 40th percentile.

In 1998, DoD changed the allowance from BAQ/VHA to BAH. This break is important. Before 1998, the allowance was based on actual expenditures, which would reflect leases signed over a period of time and thus would include lagged market rates as well as possible distortions resulting from lower than intended allowances. In 1998, the allowance began to reflect current rental prices. This would remove some of the lag in reflecting market rents that was shared by the allowance and the FMR and would also increase the allowance relative to the market rents.

These data do not prove that the allowance had no effect. It is possible that without an allowance, the market rents would have fallen

even further, so that in the declining market the allowance had a stabilizing impact. Further, because the FMR responds with a lag to actual rents, it might not reveal some of the effects. However, the data do suggest that the allowance did not have a dominant effect on market rents.

Rental advertisement data

The data used to compile the FMR are high quality, but they have some weaknesses. The FMR applies to the Honolulu metropolitan area, which is the entire island of Oahu. Also, because the FMR projects rents forward from data that can be as much as 15 months old, the data may lag somewhat. An alternative source of data is advertised rents. These would reflect current asking prices, and are available for sub-markets within the Honolulu metropolitan area. We use advertised rent data to examine the effects of housing allowances.[10]

Oahu rents and allowance

Between 1991 and 1997, the median advertised rent for a two-bedroom apartment fell and allowances rose (figure 8). The E-5 allowance appears to have been slightly more stable than the market in the late 1990s, and both the market and the allowance increased in 2001. The figure does not strongly support the concept that allowances drive rents, but the similar patterns at the end of the data may indicate some influence. The BAH increase in 2001 was designed to be large relative to the market changes. This rise may have affected market rents although the market growth rate was even higher than the growth rate of the E-5 allowance. The similarity may also indicate that the BAH, which is designed to more accurately reflect market rents, is doing so.[11]

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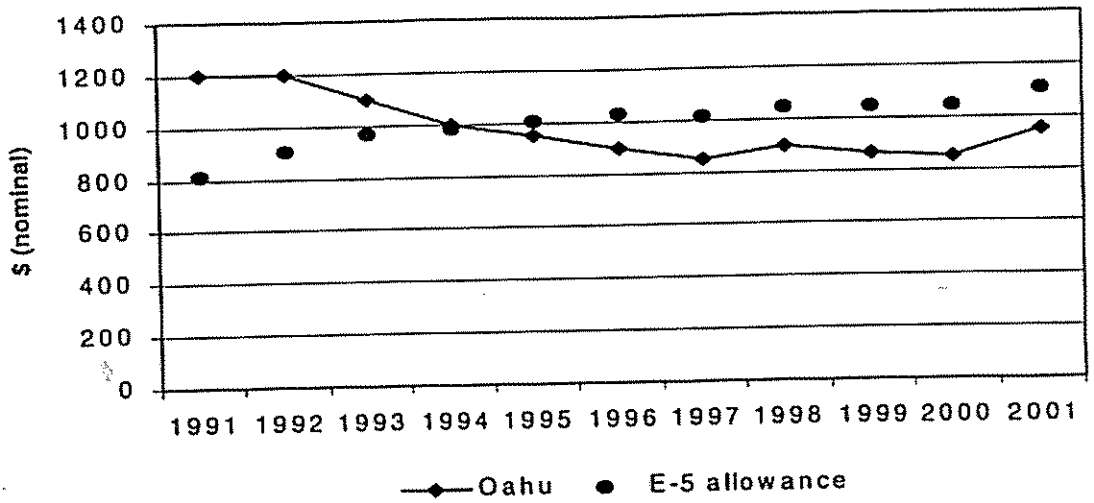
10. We thank Harvey Shapiro, Research Consultant, for the advertising data. A comparison of the advertising data and the FMR is provided in appendix A.

11. This analysis is designed to examine how market rents move relative to the allowance, rather than comparing the levels of the allowance and the rent. Such a comparison is invalid because allowances are not necessarily based on the same housing standard as the advertising data, and the allowance is intended to cover utilities costs, which are not included in the advertising data.

Figure 8. Median rent for a two-bedroom apartment rent in Oahu and Oahu E-5 allowance



Comparing allowance and rent in military concentration areas

Housing markets are likely to be more localized than the entire metropolitan area. We thus focus on rents in two areas—Pearl City, near Pearl Harbor and Hickam AFB, and Mililani Town, near Schofield Barracks—that might be expected to show any effects of allowances. Table 5 indicates that these are areas with a high concentration of military personnel (Mililani Town is in Central Oahu). For comparison, we again considered two-bedroom apartments and the E-5 allowance.

Figure 9 graphs the allowance and the two-bedroom apartment rents in Pearl City. These additional data suggest that the market asking prices are not driven by the allowances. In the early 1990s, the allowance was rising, while rents were generally trending downward. By the mid 1990s, rents appeared to have stabilized, or at least the downward trend had slowed, while the allowance continued to rise slowly. The more recent data appear to be more volatile, but the changes do not appear to be closely related to changes in the allowance.

Similarly, figure 10 suggests that rents in the Mililani Town market fell through the 1990s until around 1998, while the allowance generally rose. Only the last observations, where both rents and allowances rose, appear to coincide.

Figure 9. Advertised rent for two-bedroom apartments in Pearl City and Oahu E-5 allowance

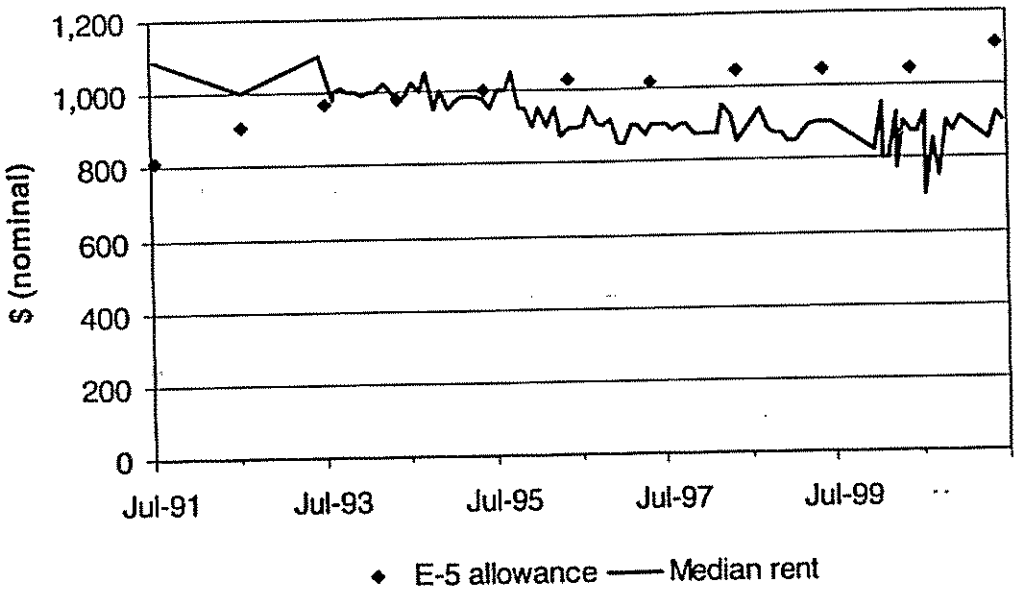
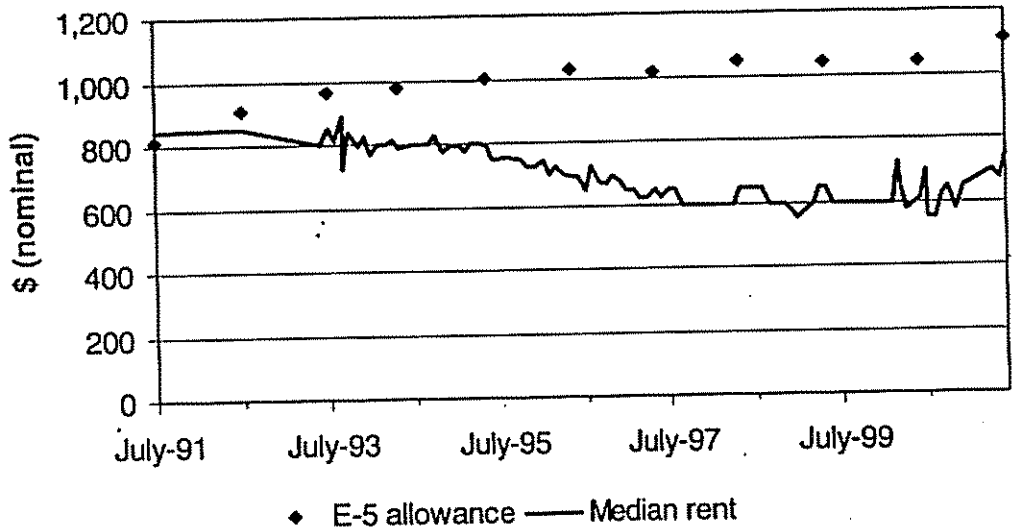


Figure 10. Advertised rents for two-bedroom apartments in Mililani Township and Oahu E-5 allowance



These graphs do not prove conclusively that the allowance does not affect the rental market, but they do suggest that the allowance is not the dominant factor in the market.

Comparing rents in military and non-military concentration areas

Another approach is to compare the history of rents between areas with low and high concentrations of military renters. Figures 11 and 12 compare rents in Mililani Town with rents in University/Manoa and East Oahu. The University of Hawaii/Manoa and East Oahu areas are neighborhoods of Honolulu and were reported to have a relatively low concentration of military personnel. Thus, if allowances have an effect on local housing markets, these areas are less likely to be affected. Similarly, the trends between Mililani and East Oahu and University/Manoa have the same shape. (East Oahu is much more volatile, so trend lines have been added.)

Figure 11. Advertised rents for two-bedroom apartment in military and non-military concentration areas

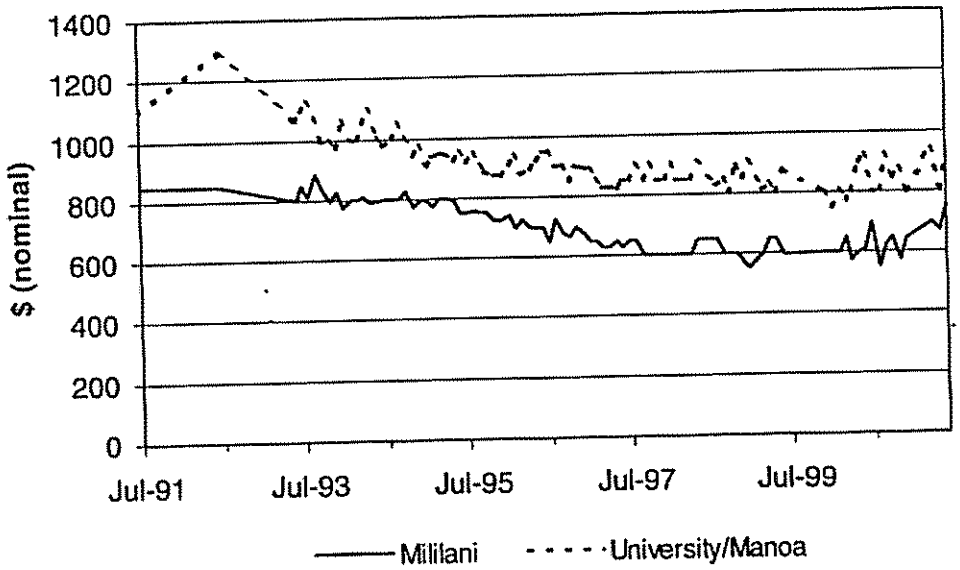
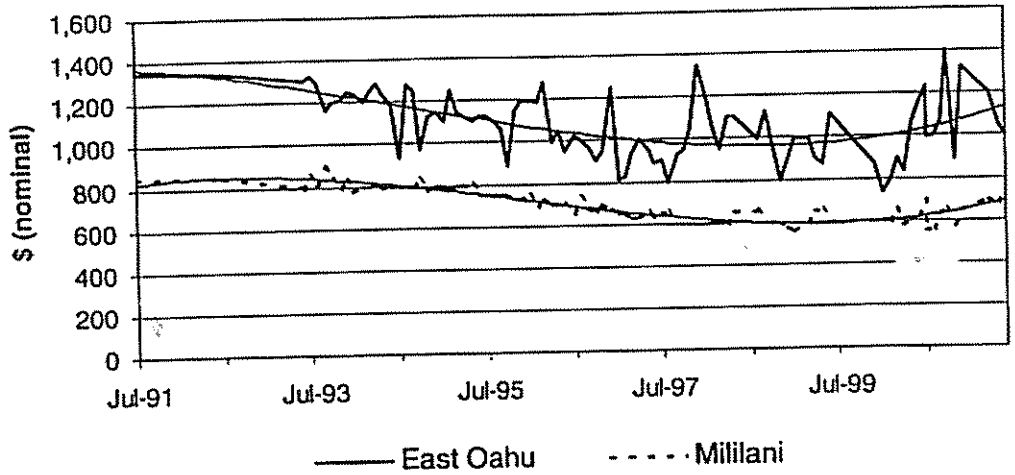
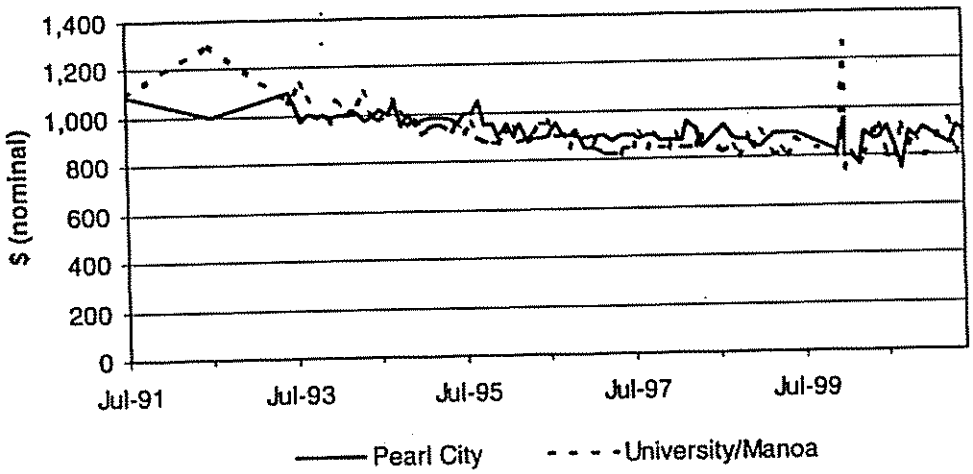


Figure 12. Advertised rents two-bedroom apartment in military and non-military concentration areas



To provide a comparison of areas with rents typically closer together, we compare the rents in Pearl City with the rents in the University/ Manoa area. Figure 13 shows that the rental prices in the University/ Manoa area show the same trend as the rental prices in Pearl City, which has a high military concentration. Again, this is not conclusive evidence, but it suggests that factors other than the allowance are driving the rental market.

Figure 13. Advertised rents for two-bedroom apartments in military and non-military concentration areas



Estimating allowance effects in Oahu

In this section, we discuss two approaches to estimating the effect of allowances on rents in Hawaii. In general, both indicate that the effects of allowances on local rents are negligible.

Estimation using comparison areas in Oahu

Market rents are subject to a number of influences. These include the characteristics of the housing unit and its location, vacancy rates, and macroeconomic influences such as income and population. Specifying all the variables that will affect rental markets is difficult. However, if we assume that the allowance affects only those areas that have a high concentration of military renters, and that all the other influences on rents affect both military and non-military markets the same, then a simple regression using the rent in the non-military area as a proxy for influences other than allowance on rent can test the effect of the allowance on rents. If we use this method, however, we must assume that there are no spillover effects from the military to non-military markets. This may not be valid. For example, if the allowance causes higher rents in Mililani, some renters may elect to live in other markets, thereby increasing demand and the rents in those markets. We can mitigate these spillover effects by using an area that is farther from military bases, or has higher rental prices, as a control. The long commute and higher prices would limit the migration from the areas with a high concentration of military to the control area. The disadvantage of using these areas is that we introduce the possibility that the market influences in the "control" area might be different from those in the military area. An alternative is to compare areas where rents are more nearly the same, though this introduces the possibility of spillover effects.

We estimate models of rent where the explanatory variables include a composite of the rents in areas with a low share of military renters. Four of the control areas—Waikiki, Manoa/University of Hawaii, Downtown, and East Oahu—have higher rents and are some distance from military areas. We also use Kailua, which has higher rents but is near MCAS Kaneohe Bay, and Makiki, which is near Downtown and somewhat closer to the military bases, but has rents that are closer to those in Mililani than to those in other control areas. We formed the

composite by weighting the median rent in a market by the share of the ads in the data set. We defined a market by the geographic area, the number of bedrooms, and the type of dwelling (apartment, townhouse, or house).[12]

The model includes a composite measure of the allowance, and this allowance interacted with the percentage of the population that is military.[13] We formed the composite allowance by multiplying the share of military family housing renters in the paygrade bands used in [12] by an allowance in that paygrade.[14] The military population term does not adjust for the share of the military living in government quarters, a potential weakness of the data. The model also includes controls for vacancy rates, per capita income, Oahu population, unemployment, and a time trend. Table 6 lists the results of estimating models of rents.

The first column in table 6 uses the composite rent in Mililani as the dependent variable.[15] The control rent is highly significant, indicating that the macroeconomic controls do not capture all features of

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12. Appendix A provides estimation results using specific markets for controls.

13. Real rather than nominal allowances, rents, and income are used.

14. Specifically, the composite allowance is .07(E-3) + .61(E-5) + .14(E-7) + .09(O-2) + .07(O-4) + .01(O-6) where the paygrades are the allowances at that paygrade. Reference [12] reports number of renters in bands. Generally, a middle paygrade is selected. This was likely non-representative for some bands, so a different paygrade in the band was chosen. For example, in the E-1 to E-3 band, the E-3 allowance is used, since most renters in this band are more likely to be E-3 than E-1. Using this composite imposes the assumption that the shares of military family renters represent the shares of all military renters. Note that the correlation between allowances between 1991 and 2001 is generally .8 or higher. Exceptions are E-2 and O-1 allowances, which have much lower correlations with other allowances.

15. The regression results presented correct for autocorrelation because the Durbin-Watson statistics for these models indicate the possibility of autocorrelation. The Prais-Winsten estimator is used. Given the short time-series used in the regression, this estimator is preferred. See [15, p. 601].

the market. The coefficients on the allowance and the interaction of allowance and military population are insignificant, both individually and jointly (an F-test of their joint significance has a p-value of .69). The parameter estimates imply an elasticity of Mililani rents with respect to allowances of -.01, with a standard error of .26.[16] This suggests that as a whole, the allowance does not affect rents in Mililani. However, the relatively large standard error means that it is plausible that the elasticity could be as high as .5.

Table 6. Models of Mililani rents using non-military areas as a control[a]

Modeled rent	Mililani composite (1)	Mililani two-bedroom apartment (2)	Mililani two-bedroom townhouse (3)	Mililani three-bedroom townhouse (4)	Mililani three-bedroom house (5)
Control rent	0.516	0.340	0.298	0.548	0.806
	(4.48)***	(3.79)***	(3.23)***	(3.63)***	(3.12)***
Allowance	-0.203	-0.353	-0.314	0.018	-0.112
	(0.62)	(1.35)	(1.17)	(0.04)	(0.15)
Allowance* MilitaryPop%	4.604	13.021	10.440	-3.641	-4.813
	(0.86)	(3.08)***	(2.40)**	(0.52)	(0.41)
Vacancy rate	0.867	1.398	4.432	-1.556	-2.456
	(0.18)	(0.37)	(1.15)	(0.25)	(0.24)
Per capita income	0.047	-0.001	0.017	0.098	0.120
	(2.06)**	(0.06)	(0.91)	(3.30)***	(2.42)**
Population	0.002	0.003	0.004	0.001	0.002
	(1.71)*	(2.48)**	(3.33)***	(0.72)	(0.69)
Unemployment rate	3.087	-10.297	-7.272	15.124	30.822
	(0.42)	(1.79)*	(1.23)	(1.58)	(1.91)*
Date	-0.616	-0.816	-1.260	-0.829	0.474
	(1.04)	(1.73)*	(2.61)**	(1.07)	(0.37)
Constant	-2,548.910	-1,584.812	-2,572.210	-2,812.284	-4,688.960
	(2.15)**	(1.68)*	(2.65)***	(1.80)*	(1.80)*
Observations	88	88	88	88	88
R-squared	0.96	0.98	0.98	0.95	0.84
Implied elasticity	-0.01	0.28	0.17	-.14	-.29
Standard error for elasticity	.27	.11	.15	.38	.71

a. Absolute value of t-statistics in parentheses.* significant at 5%; ** significant at 1%.

16. The elasticity is calculated at the observed means in the data.

We also model rents for more specific markets in Mililani. Column 2 presents the results of a model using two-bedroom apartments in Mililani as the dependent variable. In this model, the allowance has a negative coefficient with a p-value of .18. The interaction is positive and significant at the 1-percent level. The implied elasticity of two-bedroom apartment rents in Mililani with respect to allowances is .28, with a standard error of .11. This significance indicates that the two-bedroom apartment market is sensitive to increases in allowances. Military personnel may be an especially large component of this narrowly defined market, so that the allowance has a bigger effect. (The Mililani three-bedroom apartment has similar estimates.) Applying this elasticity to the 8.9-percent increase in the allowance that would eliminate out-of-pocket expenses indicates that rents for these apartments would rise about 2.5 percent, or about $23 (using the 2001 rental price). Columns 3 through 5 present the results using other dwellings in Mililani as the dependent variable. Although the pattern is similar, the elasticity in each is insignificant.

In general, these models have positive coefficients on the interaction variable, which is offset by the negative coefficient on the allowance variable, usually leading to small positive and insignificant net effects. However, if the military made up a much larger share of the market, then the positive coefficient on the interaction could dominate, thus leading to larger net effects. (In calculating the elasticities, we held the military percentage constant at the mean.) Figure 4 indicates that the military comprised a larger share of the population in the 1980s, so the effects may have been larger then. We also emphasize that these are the immediate effects of the allowance. As the market supply adjusts over time, the effects will be diminished.

Estimation of a simultaneous equations model of the rental market

An alternative is to estimate a simultaneous model of supply, demand, and rents for Oahu. Such a model can provide Oahu-specific estimates of the income elasticity of demand and the resulting effect on rents while specifically accounting for the endogeneity of rent, demand, and supply. A simple model adapted from a commercial real estate model estimated by Benjamin, Jud, and Winkler [16] is

estimated here. With the available data, we can only apply the estimates to determine an Oahu-wide effect of an income increase from allowances.

We model supply as a function of the previous period's supply, the previous period's rent, and the previous period's cost of construction. The intuition for including lagged supply is that the number of rental units is likely to have significant persistence; the number of units this period is the previous period adjusted for removals and additions. Landlords decide whether to add or reduce the number of units by evaluating the rents they expect, which is proxied by the current rent and the cost of construction. We hypothesize that higher rents in one period attract more supply in the later periods. Higher construction costs lower the return on investment and thus reduce the number of new units that are built, so the coefficient should be negative. Because of the time required to build units, we include these prices with a lag of one year. Thus, the current period's supply of rental units is already determined when the period starts.

We measure demand as the number of units rented. We model demand as a function of current period rent and household income. Higher rents should lead to lower demand, and higher incomes should lead to higher demand. This relies on the assumption that demand for the number of units serves as an adequate proxy for the demand for housing services. The difference is that, as income rises, an individual household might demand "better housing"—with more amenities or a better location, for example—but still rent only one unit. We rely on the assumption that the demand for housing units also represents the demand for services. This might occur, for example, if an increase in income caused some people who had shared a housing unit to move into their own units.

Rents are assumed to be a function of past rents and current vacancies, defined as the difference between supply and demand. Supply does not have to equal demand. The hypothesis is that the price will be lower as vacancies rise, as landlords engage in price competition to attract tenants.

Rent and demand are determined simultaneously. Higher rents reduce demand, which increases the vacancy rate. This, in turn,

lowers demand, which acts to dampen the price. Thus, this models the dynamic interaction between demand and price, with supply determined in each period. Incorporating this simultaneous determination of income and prices expressly addresses the causality. Because the allowance is an increase in income, we can determine the effects of an allowance increase on demand.

Formally, this is modeled as

$$s_t = \alpha_0 + \alpha_1 s_{t-12} + \alpha_2 p_{t-12} + \alpha_3 c_{t-12} + \varepsilon_{st} \quad (1)$$

$$d_t = \beta_0 + \beta_1 p_t + \beta_2 m_t + \varepsilon_{dt} \quad (2)$$

$$p_t = \gamma_0 + \gamma_1 p_{t-1} + \gamma_2 v_t + \varepsilon_{pt} \quad (3)$$

$$v_t = s_t - d_t, \quad (4)$$

where the subscript represents the time period, s_t is the supply, d_t is the demand, p_t is the rent, v_t is the number of vacancies, c_t is the cost of construction, and m_t is income. This system is estimated by three-stage least squares using monthly time series for Oahu.[17] The estimates are listed in table 7. The data available limit the time series to 10 years, so we should interpret these estimates with caution. We used logarithmic transformations of the data, so the coefficients indicate elasticities.

The results indicate that the income elasticity of demand for housing is .24. This means that a 1-percent increase in household income will increase demand for housing by .24 percent. This is within the range of estimates in the literature cited earlier. The price elasticity is -.16,

17. We used monthly data to obtain more degrees of freedom, though this requires using some annual averages as monthly observations. In addition, in a given period, we modeled supply as predetermined. Thus, the supply equation could be estimated separately from the rent and demand equations. However, to estimate separately, we would have to assume that the error in the supply equation is uncorrelated with the errors in the other equations. Details on the data and estimates using alternative specifications are provided in the appendix.

which is slightly lower than other estimates in the literature. All coefficients have the expected sign and are significant.

Table 7. Simultaneous equations model of the Oahu rental market[a]

Ln(supply)		Ln(demand)		Ln(rent)	
Ln(supply)	.972	Ln(rent)	-.163	Ln(rent)	.826
(12-month lag)	(.045)***		(.017)***	(1 month lag)	(.051)***
Ln(rent)	.011	Ln(household	.240	Ln(vacancies)	-.105
(12-month lag)	(.005)**	income)	(.033)***		(.039)***
Ln(cost)	-.016				
(12-month lag)	(.005)***				
Constant	.328	Constant	10.331	Constant	2.121
	(.570)		(.264)***		(.627)***
Observations	66		66		66
R-squared	.994		.567		.881

a. Absolute value of t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

This model provides a reasonable picture of the dynamics of the housing market. However, the coefficient on income indicates only the direct effect on demand. The total effect of an increase in income on rent is this direct effect and the indirect effect of the change in income operating through supply and vacancies. The total effect is found by estimating a reduced form model of rent on the exogenous variables:

$$p_t = a_0 + a_1 m_t + a_2 p_{t-1} + a_3 p_{t-12} + a_3 c_{t-12} + a_4 s_{t-12} + \varepsilon_t$$

This model could also include current period supply as an exogenous variable, since it is predetermined in a given period.[18] Table 8 lists the estimates of the reduced form model. The model with supply endogenously estimated indicates that a 1-percent increase in income will increase rents by .2 percent. The p-value on the coefficient is .18.

18. We discuss and present a simultaneous equations model with supply independent in appendix A.

With supply included as an exogenous variable, the coefficient is .38. Both estimates are reasonable when compared to the estimates in the literature.

To apply this estimate to the question of how an allowance increase affect rents, we again consider the potential effects of eliminating out-of-pocket expenditures. Eliminating these expenses represents an income increase of at most 5 percent. Military personnel and their dependents represent about 10 percent of the island's population. Thus, we calculate the aggregate change in income of increasing the allowance to be no more than .5 percent. Applying the elasticity of .2, we estimate an increase in rents of .1 percent. This translates into a $1 increase in monthly rent for a unit renting for $1,000. The higher estimate would double this, but it is still an economically insignificant amount. We should emphasize that the estimates apply to the island as a whole. The effects could be larger in localized neighborhoods.

Table 8. Reduced form model of rents in the Oahu; dependent variable is Ln(rent)[a]

Variable	Supply endogenous	Supply exogenous
Ln(household income)	0.215	0.382
	(1.36)	(2.09)**
Ln(supply)	-3.358	-4.054
(lagged 12 months)	(1.95)*	(0.87)
Ln(supply)		-8.231
		(1.71)*
Ln(rent)	0.111	0.152
(lagged 12 months)	(0.61)	(0.84)
Ln(construction cost)	0.030	-0.056
(lagged 12 months)	(0.17)	(.32)
Ln(rent)	0.327	0.247
(lagged 1 month)	(2.50)**	(1.80)*
Constant	41.159	49.805
	(1.93)*	(2.31)**
Observations	66	66
R-squared	0.92	0.92

a.Absolute value of t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Allowances and the Fort Campbell area rental market

Fort Campbell, Kentucky, is a large military base located in an urban setting much smaller than Oahu. In this less populated area, the effect of allowances on local rental prices may not be the same as in Hawaii. This section describes the housing market around Fort Campbell, and presents data on the effects of allowances in the market.

Clarksville-Hopkinsville demographics and market description

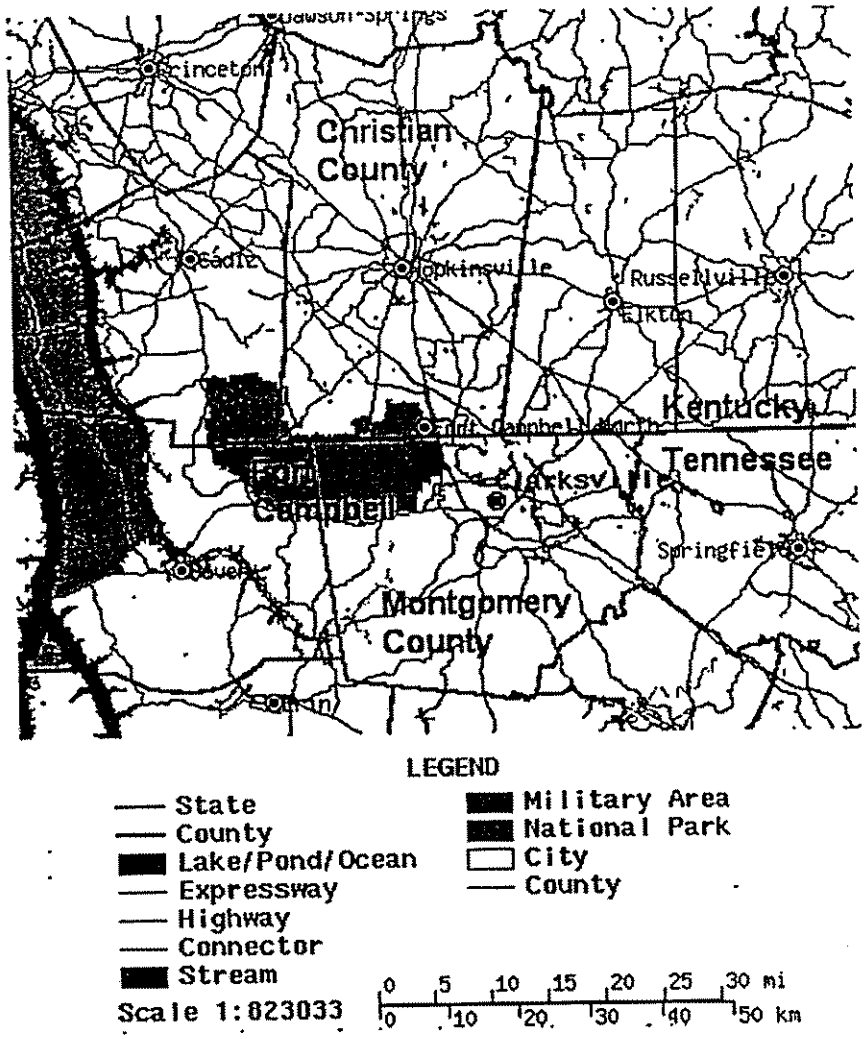
Geography of the local housing market

Fort Campbell is situated in parts of Montgomery and Stewart counties in Tennessee and Christian and Trigg counties in Kentucky. Clarksville, Tennessee, is to the immediate east and southeast of the base. Oak Grove, Kentucky, is to the immediate northeast of the base, and Hopkinsville, Kentucky, is about 15 miles north of the base. Together, Montgomery and Christian counties comprise the Clarksville–Hopkinsville Metropolitan Statistical Area (MSA). Seventy percent of the people in Montgomery County and 50 percent of the people in the MSA reside in Clarksville. Nashville is 55 miles southeast of Fort Campbell. Figure 14 is a map of the MSA.

Discussions with base housing personnel and local real estate professionals indicate that most of the military personnel living off-post live in Clarksville. The city of Clarksville encompasses about 95 square miles. As such, it is 50 percent larger than Washington, DC, though it has only 20 percent of the population. There are large undeveloped areas within the city boundaries, and much of this undeveloped area is suitable for housing. The Cumberland River flows through Montgomery County and forms the southern border for much of

Clarksville. Only one bridge crosses the river, and sewer lines have not been extended to the south side of the river. Thus, there is little rental property south of the Cumberland River.

Figure 14. Fort Campbell and surrounding area[a]



a. Source: Census TIGER mapping files. Clarksville city boundary updated by author.

Housing units

Table 9 shows that the housing stock in Clarksville–Hopkinsville, especially in Montgomery County, expanded significantly between 1990 and 2000. The number of rental units in the MSA (the total renter-occupied and vacant units) increased by 22 percent between 1990 and 2000. Almost 80 percent of this growth was in Montgomery County. The number of owner-occupied homes increased by 37 percent. The number of annual building permits issued, shown in figure 15, reflects the growth. The figure shows that in 2001 permits were issued for 524 units in multiple-unit structures, and for 1,084 single-unit residences. These data indicate fairly volatile building of multiple-unit structures. The two most noticeable declines were in the early 1990s which coincided with a national recession, and in 1998.

Table 9. Housing stock, Montgomery and Christian Counties, 1990 and 2000[a]

	Montgomery County, TN			Christian County, KY		
	1990	2000	Change	1990	2000	Change
Owner occupied	20,983	30,700	0.46	11,564	13,743	0.19
Renter occupied	13,362	17,630	0.32	10,072	11,114	0.10
Vacant	2,888	3,837	0.33	1,793	2,325	0.30
Total	37,233	52,167	0.40	23,429	27,182	0.16

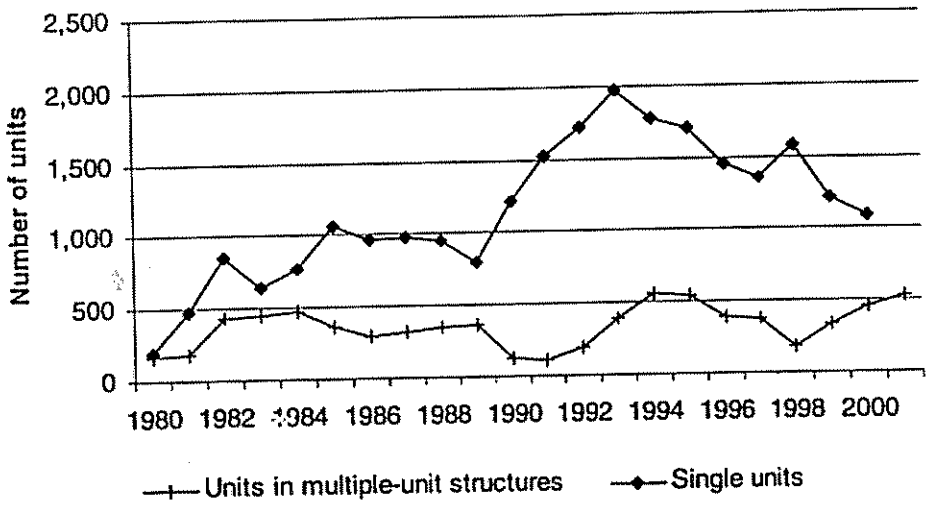
a. Source: Census Bureau data.

Population

Population in the Clarksville–Hopkinsville MSA grew by 21 percent during the 1990s. Most of this growth occurred in Montgomery County, Tennessee, which grew by 33 percent. In contrast, Christian County, Kentucky, grew by only 5 percent.

A major part of the local population is military. There were 23,227 servicemembers stationed at Fort Campbell at the end of FY 2001, down from more than 24,000 in 1995. Since 1997, however, when 23,316 personnel were assigned, the population has remained steady. Including dependents, nearly 42,000 people are now stationed at Fort Campbell.

Figure 15. Housing units authorized by building permits in Clarksville-Hopkinsville MSA, by single- and multiple-unit structures[a]



a. Source: Census Bureau.

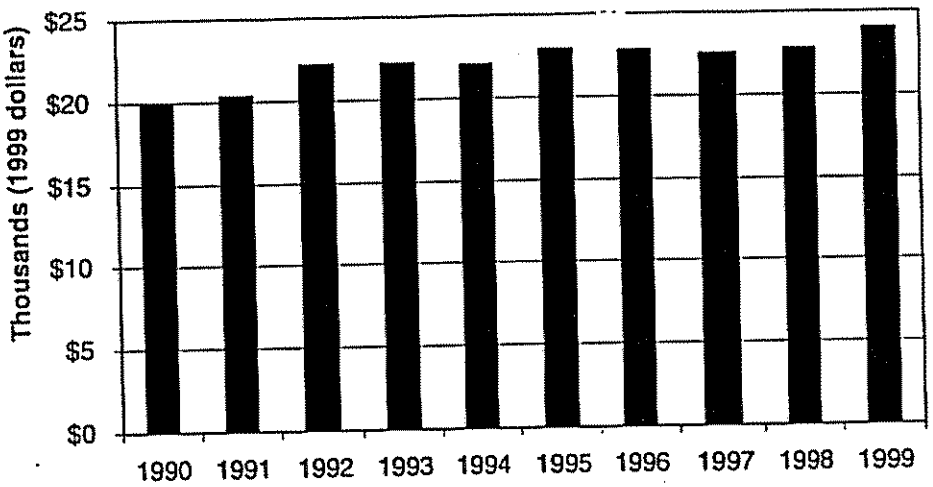
A large number of the military population lives in community housing. The 2000 Family Housing Market Analysis (FHMA) states that in 2000 there were 9,243 military family renters and 3,712 military family homeowners. In addition, all single E-6s and above are required to live off-base. The 2000 FHMA reports 783 single E-7s and above, and 3,548 single E-4s to E-6s. E-6s make up about 18 percent of the E-4 to E-6 population assigned to Fort Campbell; thus we estimate that there are an additional 644 single E-6 renters.[19]

19. The percentage of single E-6s is probably lower than the percentage of single E-4s and E-5s because senior enlisted personnel are more likely to be married. Thus, we may have overstated the number of single E-6 personnel. Further, some of these individuals may own homes rather than rent. However, some more junior enlisted personnel may also rent.

Income

Income in Montgomery and Christian counties grew 20 percent between 1990 and 1999. Figure 16 presents the real per-capita annual income in Montgomery County, Tennessee, from 1990 to 1999. Census Small Area Income Estimates show a median household real income growth between 1989 and 1997 of about 8 percent in Montgomery County, to $35,728, and 3 percent in Christian County, to $27,968.

Figure 16. Real per-capita annual income in Montgomery County, Tennessee[a]



a. Source: Tennessee Department of Labor and Workforce Development.

Vacancy rate

Data on annual vacancy rates for the Clarksville–Hopkinsville MSA and counties are not available. Table 10 lists the vacancy rates reported in the 1990 and 2000 censuses.

Table 10. Rental vacancy rates in Montgomery and Christian counties[a]

Year	Montgomery County, TN	Christian County, KY
1990	9.3%	6.3%
2000	7.3%	7.1%

a. Source: Census Bureau.

The Fort Campbell area market and the conditions under which allowances affect rents

Demand conditions

Three conditions are required if allowances are to significantly increase demand:

- The allowance increase must be large.
- The portion of the allowance increase that individuals devote to additional housing must be large.
- The share of the renter market receiving the allowance increase must be large.

The Fort Campbell rental market has the potential to be influenced by allowance increases. Because an allowance increase represents a higher percentage pay increase for junior servicemembers, the high concentration of junior enlisted personnel has the potential to make an allowance increase relatively large. Similarly, the high concentration of junior personnel might make the portion of the allowance increase that individuals devote to additional housing large, because the share of an income increase that is devoted to housing is inversely related to income. Finally, because Fort Cambell is a very large presence in the local area, the potential to impact the demand exists.

Relative size of allowance increase

To illustrate the effect of raising the housing allowance, we again consider an allowance increase that eliminates out-of-pocket costs. The out-of-pocket cost is designed to be the same in all geographic locations. The BAH for Fort Campbell is relatively low, so eliminating the out-of-pocket cost will result in a slightly higher increase in income

than in locations with a higher cost of living. Table 11 shows the increase in income for selected paygrades. Note that even in this lower cost-of-living location, eliminating out-of-pocket costs would raise E-5 BAH by 20 percent, and increase total income by only 4 percent—and less for personnel at higher paygrades.[20] (For comparison, in Oahu, with a much higher BAH and thus higher total compensation, eliminating the out-of-pocket cost would increase E-5 income by 3.2 percent.)

Table 11. Increase in monthly income as a result of eliminating out-of-pocket costs in Fort Campbell, selected paygrades

Grade (years of service)	BAH ($)	BAH + Basic pay + BAS ($)[a]	Out-of-pocket cost[b] ($)	Percentage increase from eliminating out-of-pocket cost	
				In BAH	In compensation
E-3 (2)	495	2,122.00	99	20.0%	4.7%
E-5 (6)	526	2,680.40	106	20.2%	4.0%
E-6 (8)	584	3,080.10	122	20.9%	4.0%
E-7 (12)	615	3,583.00	129	21.0%	3.6%
O-1 (1)	559	2,822.97	108	19.3%	3.8%
O-3 (6)	666	4,708.07	142	21.3%	3.0%
O-4 (10)	807	5,669.57	160	19.8%	2.8%

a. BAS is Basic Allowance for Subsistence. For enlisted personnel, the standard rate of $241.60 is used. If rations in kind are not available, the BAS is $262.50.
b. The out-of-pocket cost is the absorption rate for personnel with dependents.

Anticipated increase in housing demand

As discussed earlier, an increase in the BAH is equivalent to an increase in income. Applying the .35 elasticity estimate of Hansen, Formby and Smith suggests that the increase in demand for housing services by servicemembers living in private housing would be about 1.4 percent at the E-5 paygrade and lower for higher paygrades. This is a slightly higher impact per recipient than in Hawaii, where the increase in demand for an E-5 is estimated to be 1.1 percent.

20. The percentage increase in actual pay is probably less because Fort Campbell is home to the 101st Airborne Division. Airborne troops qualify for incentive pay, thus lowering the relative increase in income from raising BAH. The calculation also omits clothing allowances.

Share of market receiving the allowance

Personnel living off-base will receive the allowance.[21] The number of family renters reported in the 2000 FHMA was 9,243. When we add the number of single E-7s and above and the estimated number of single E-6s who are required to live off-post, we get a total of about 10,700 military renters.[22] To estimate an upper bound on the share of the market that will receive the housing allowance, we assume that all renters live in Clarksville. This would make about 63 percent of the rental market military households [17].

Demand impact

The net impact in demand is determined by multiplying the estimated individual increase in demand times the share of the market receiving the allowance. If about two-thirds of the market increases its demand by 1.4 percent, the market demand increases by about 1 percent. This estimate is probably high because we assume that the entire demand is directed to Clarksville, rather than expanding to the rest of Montgomery County and Christian County.

This estimate may vary depending on the concentration of military personnel within neighborhoods. In neighborhoods with less than 63 percent military, the impact would be smaller. Even in a neighborhood with all military renters, the impact would still be only about a 1.4-percent increase in demand.

Supply conditions

For allowance increases to have a long-run impact on rents, supply must be constrained from expanding to meet the higher demand caused by an income increase. The data on the growth in rental property indicate that there are minimal constraints on supply in Montgomery County, Tennessee. Interviews with the base housing referral

21. An increase in the allowance could change the mix of people living on- and off-post. The average wait for on-post housing is 15 to 17 months. This suggests that the military housing has a high demand, and an increase in the allowance might have negligible impact on the military housing demand.

22. Because some renters will live outside the MSA, these should be interpreted as an upper bound.

office and local real estate professionals confirm that, in the past, zoning and permits have not presented obstacles to building housing.

One local real estate professional estimated that the largest landlord in Clarksville owns about 800 rental properties, and two other landlords own about 600 each. Thus, the three largest landlords own about 2,000 units, which is less than one-eighth of the Clarksville rental market. Further, entry into the market seems particularly easy. Thus, monopoly or oligopoly power is unlikely to allow landlords to raise rental prices after an allowance increase.

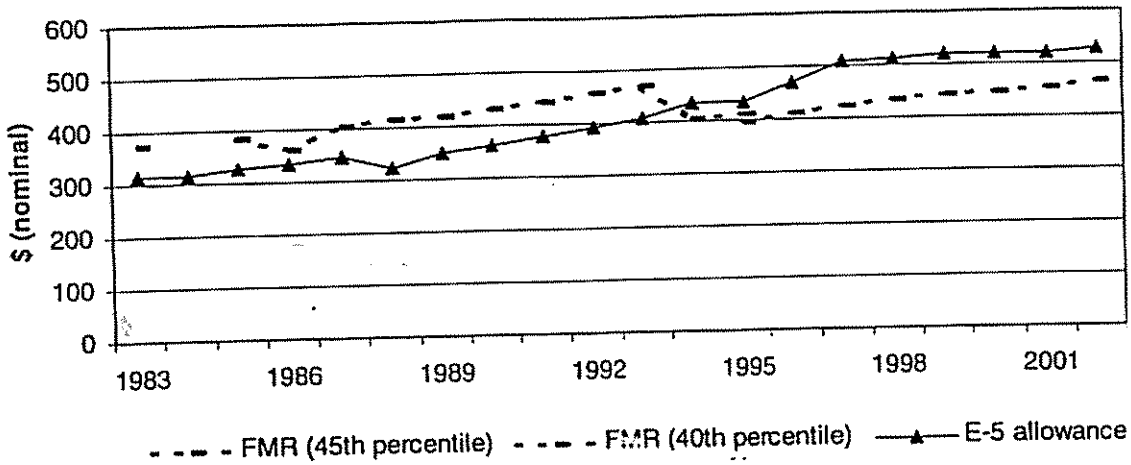
Allowance and rent data for the Clarksville–Hopkinsville area

HUD Fair Market Rent data

Figure 17 shows the HUD FMR rent and the E-5 allowance. Some of the data provide interesting comparisons. Most significantly, from 1993 to 1994, the allowance grew by 7 percent, faster than the 4-percent annual growth between 1990 and 1993. (From 1989 to 1993, VHA for most ranks in Fort Campbell was zero, so the growth in the allowance was only the growth in BAQ.) FMR had been growing at a 2- to 3-percent rate between 1990 and 1993. However, between 1993 and 1994, FMR fell by 13 percent. Because FMR is a forward projection of rents, this may well reflect a drop in rents in late 1991 and 1992. Local real estate professionals and the base housing referral office report that the deployment during Operation Desert Shield and Desert Storm depressed the local rental market, which may have caused the observed FMR drop in 1994. As could be expected in a market with falling rents, the allowance did not rise the following year, though rents rose marginally. In the next two years, allowances rose significantly—7.9 and 9 percent annually—but FMR rose only 3 percent. In 2000 and 2001, the allowance was unchanged, but FMR slowly rose. These trends do not suggest that the allowance drives the FMR.[23]

23. The FMR data also shows a drop in 1986 with no corresponding changes in the allowance. Because this was a temporary drop, it may be due to measurement error, though a similar drop occurred in only one other Tennessee MSA (the Johnson City–Kingsport–Bristol MSA). The 1993 drop was a permanent drop.

Figure 17. HUD Fair Market Rent in the Clarksville–Hopkinsville MSA and E-5 allowances at Fort Campbell



ACCRA data

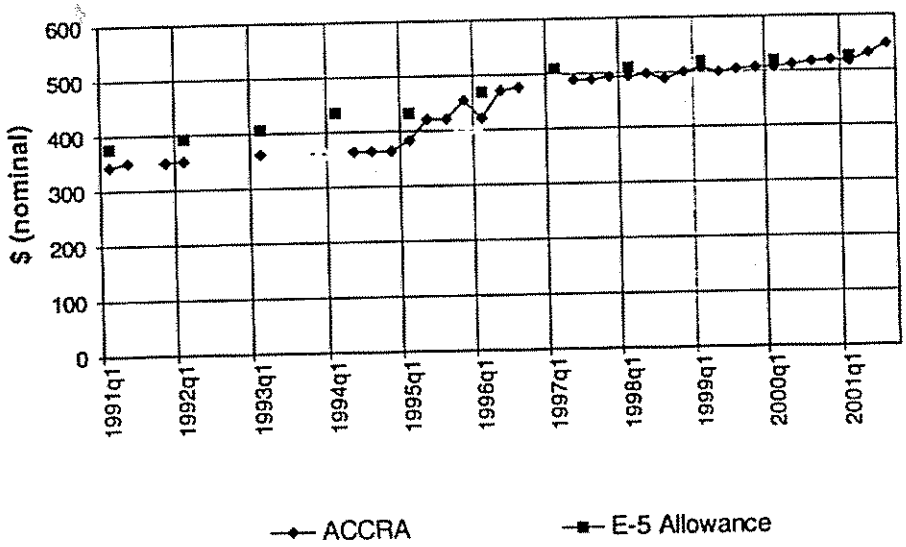
Local community agencies and organizations submit data on local prices to ACCRA, which are used to compile a cross-city cost-of-living-indicator. These data include the cost of renting an apartment suitable for a childless couple with income in the top 20 percent for the market.[24] Figure 18 presents the available ACCRA data since 1991 for Clarksville–Hopkinsville.[25] Unfortunately, the data are sparse between 1991 and 1994 when FMR dropped. These data present a different picture than the FMR data. They also show a higher growth in rent in the 1995 time span than do the FMR data, which also corresponds more closely with the increase in allowances. The allowance and the reported rents do not correspond exactly. From 1992 to 1994, allowances increased while rents appeared stable. From 1994 to 1995, allowances were stable, while ACCRA reported rents grew. Although

24. Specific criteria for apartments to be included in the sample include a 950-square-foot unfurnished, two-bedroom, 1 and 1/2 bath apartment that is less than 10 years old. Reported rents do not include utilities.

25. ACCRA data were also missing some data from 1997 to 1998. These were provided by the Clarksville–Montgomery Economic Development Council, which submits the data to ACCRA.

the growth in allowances preceded the growth in rents, the delay in rent growth suggests that something other than allowances affected the market. The data on building permits (see figure 15) indicate that 1994 and 1995 were the two years in which the most permits were issued for units in multiple unit structures, which are likely to be additional rental units. The pressure on rents may have attracted additional supply.

Figure 18. ACCRA reported rents and E-5 allowance in the Clarksville–Hopkinsville MSA



Rental advertising data

We collected rental advertising data from the Clarksville Leaf-Chronicle covering 1990 to 2002. These data consist of the advertised rents for unfurnished two-bedroom apartments and houses in Clarksville from the first Saturday of each month. Advertising data in Clarksville are sparse; in 1991, there were only 45 advertisements for unfurnished two-bedroom apartments and houses that included a monthly rent; between 1990 and 2001, the annual mean number of advertisements for unfurnished two-bedroom apartments and houses is 315. However, in Clarksville, newspaper advertising is not the primary means of matching renters to properties. The local realtors who provide these services do not advertise all the properties they manage. Thus, the advertisements represent a subset of the market. We cannot

tell if the advertised rents are representative of the market, though the similarity with the ACCRA data suggests that it may be satisfactory. Figure 19 shows the quarterly median rents, along with the E-5 allowance for Fort Campbell.[26] Because of the smaller number of observations, we also provide a three-period moving average. These data show two noticeable downturns. One begins in late 1990 and extends into early 1991. This corresponds to the Gulf War time period, when the troops deployed and dependents may have moved to other locations. The other low point is in the second quarter of 1993. Note that these temporary drops and subsequent recoveries did not correspond to unusual changes in the allowance. The allowance also rose from 1996 to 1997, while the advertised rents fell. Since 1997, both the allowance and the advertised rents have been stable.[27]

Some of the advertisements specified a location or a particular apartment complex. Conversations with local real estate professionals and base community housing referral personnel indicated that areas close to the post and along major thoroughfares that provided easy access to the post were more likely to appeal to military renters and have a higher concentration of military personnel. Where possible, we identified "high" and "low" concentration areas. Naturally, the number of observations fall as the data are disaggregated by concentration, particularly with observations in the "high concentration" areas. These data allow us to compare areas where the allowance might influence rents with areas where the allowance is less likely to influence rents. Figure 20 shows moving averages of the quarterly data for high- and low- military concentration areas. The rents in the two types of areas are somewhat similar. Even with the moving averages, the high military concentration rents are more volatile, but they generally revert to the "lower military concentration" rents.

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26. A comparison of FMR, ACCRA, and advertising data is provided in appendix B.

27. This analysis is designed to examine how market rents move relative to the allowance, rather than comparing the levels of the allowance and the rent. Such a comparison is invalid because allowances are not necessarily based on the same housing standard as the advertising data, and the allowance is intended to cover utilities costs, which are not included in the advertising data.

Figure 19. Median advertised rents for two-bedroom dwellings in Clarksville and E-5 allowance

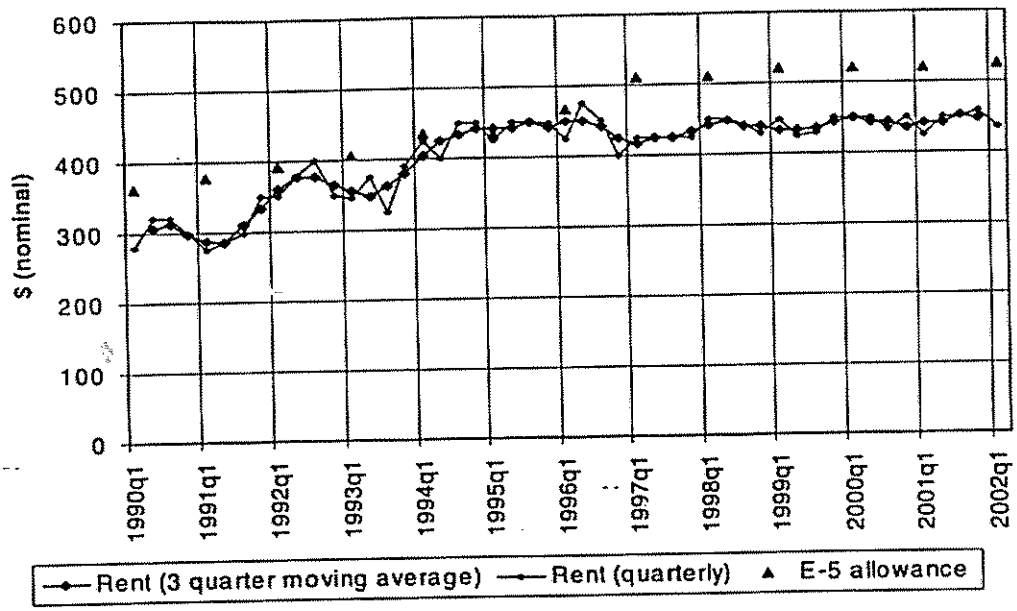
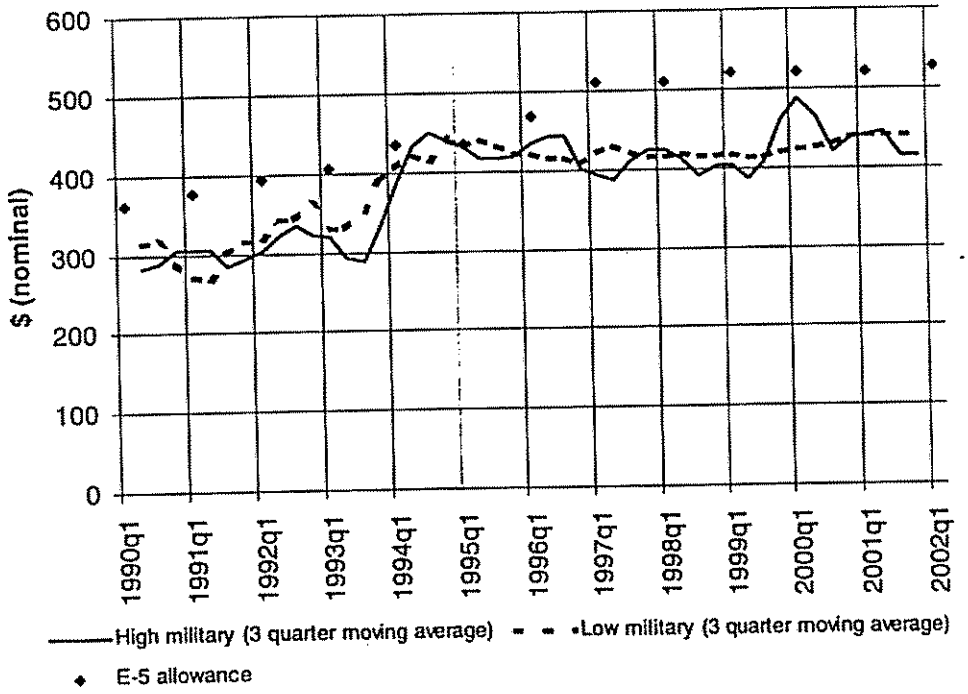


Figure 20. Median advertised two-bedroom rents in high- and low-military concentration areas of Clarksville



Estimation using comparison areas

The advertising data allow us to estimate a model similar to the one we used in analyzing the Oahu rental market, with the limitation that some of the additional controls are not available. We present estimates using both annual and quarterly data. We used quarterly data to provide additional degrees of freedom, though it requires interpolation of annual data series for some controls. (Although monthly advertising data are available, the limited number of observations each month make monthly data unreliable.)

Table 12 lists the regression results. The estimation using annual data without controls (column 1) indicates that the allowance and the allowance interacted with the military share of the population are individually and jointly insignificant in explaining rent in the high concentration areas, whereas the rent in low concentration areas is significant. When controls are added (column 2), the allowance remains insignificant, but the interaction term has a p-value of .087. Jointly, the two variables are nearly significant—an F-test for joint significance has a p-value of .1075. While the data fit the model closely, the very small sample size suggests interpreting the results with caution.

The quarterly data are much more volatile and are influenced by outliers because there are fewer data points per quarter. To reduce these problems, we used 3-month moving averages for the rent variables. The results (columns 3 and 4) indicate that none of the controls are significant at the 10-percent level. The regressions control for first-order autocorrelation, but higher-order autocorrelation may be present. The Durbin-Watson statistic for the original equation with controls is 1.24, which falls in between the upper and lower bounds on the critical values. The Durbin-Watson statistic for the transformed equation is 1.12. Again, the allowance and allowance interacted with the percentage of the population that is military are individually and jointly insignificant in the models with and without controls. However, the potential problems with the regression indicate using caution in interpreting the data.

While there are limitations to the data, they provide little support to the hypothesis that increasing the allowance would have a strong effect on rents in the Clarksville market.

Insufficient data exist to estimate a simultaneous equations model of the Clarksville rental market. Interpolating supply data would require strong assumptions. However, we cannot infer demand without data on vacancy rates, which we were not able to obtain.

Table 12. Allowance effect on high military concentration rents, using low military concentration rents as control[a]

	Annual		Quarterly[b]	
	(1)	(2)	(3)	(4)
Low military concentration area rents	0.852	0.779	0.233	0.193
	(4.38)***	(3.64)*	(1.08)	(0.85)
Allowance	-0.216	0.202	0.561	-0.002
	(0.28)	(0.09)	(1.34)	(0.00)
Allowance*military % of population	1.737	6.568	-0.889	1.430
	(1.42)	(3.17)*	(0.73)	(0.69)
Time	1.365	-107.512	0.103	-17.267
	(0.22)	(2.21)	(0.06)	(1.31)
Unemployment		-61.346		-2.919
		(1.68)		(0.35)
Income		0.005		-0.014
		(0.14)		(0.57)
Population		0.024		0.024
		(2.54)		(1.47)
Constant	-2,731.031	211,171.678	104.915	231.991
	(0.22)	(2.22)	(0.43)	(0.55)
Observations	11	10	36	36
R-squared	0.79	0.97	0.55	0.53

Absolute value of t-statistics in parentheses

* significant at 10%;** significant at 5%; *** significant at 1%

a. Regressions with additional controls have fewer observations because recent income data after 2000 are not available.

b. Quarterly regressions use 3-month moving averages for rent data, and correct for autocorrelation.

Appendix A: Oahu data and estimation

This section of the appendix provides additional information on the data on Oahu, as well as alternative estimates of the models.

Comparison of Oahu HUD Fair Market Rents and advertised rents

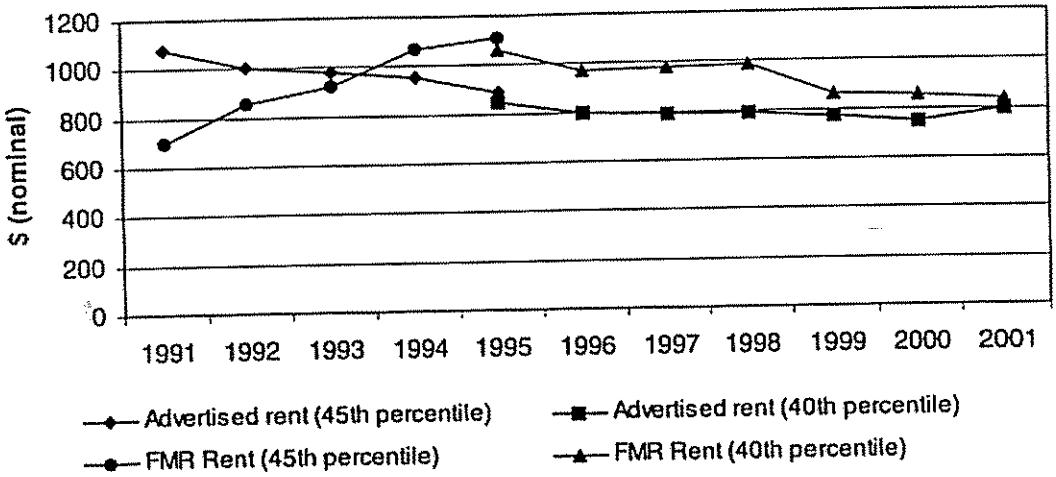
The advertising data we use in this paper consist of 168,875 rental ads. Each ad specifies the rent, whether the dwelling is furnished, the type of dwelling (apartment, house, or townhouse), and the general location on Oahu. The advertisements are generally from the first Sunday in each month, beginning in June 1993. July 1991 and July 1992 data were also included. Other gaps in the data exist.

The FMR and advertised rents differ somewhat, as shown in figure 21. To make the data comparable, we used the same percentiles in each data set. Only in the last three years have the data agreed. The FMR data from 1991 to 1995 showed increasing rents while, over the same period, the advertised rents were dropping. From 1996 to 2001, advertised rents were stable, while the FMR dropped from 1998 to 1999, and were stable thereafter. Recall, however, that FMR data are based on leases signed over the last 15 months, and are projected a year into the future. For this reason, the FMR rates are likely to lag actual market rates. And indeed, if we shift the adverstised rent data three years, the data series nearly coincide. The FMR represents a projection of trends based on current rents being paid, whereas advertising data represent the rents for leases that are currently being signed, and will be paid over the life of the lease.

Variables used in estimation

For the estimation using areas with low concentrations of military renters as a control, the rents are a composite of the median monthly rents

Figure 21. FMR and advertised rents, Oahu



for dwellings with different bedrooms and types in the specified area. The rents in the regression are in constant November 2001 dollars, deflated using the CPI index. The income is the per-capita real income. We obtained nominal income from the Bureau of Economic Analysis data, except for 2001, where we used the Hawaii State Department of Business, Economic Development and Tourism (DEBDT) December 2001 projection for 2001, published on their website. For population, we used the Census Bureau population figures; again, the 2001 data are the December 2001 DEBDT projection. The vacancy rate is the annual vacancy rate, which is assumed to be constant through the year to obtain monthly data. The unemployment figures are from the Bureau of Labor Statistics (BLS) monthly unemployment data.

For the simultaneous equations estimation, the rental price variable is the median monthly rent for two-bedroom apartments obtained from the advertising data described earlier in the paper. The supply data are constructed using building permit, demolition, and census data. The April 1990 and April 2000 rental supply is calculated as the number of renter-occupied homes plus vacant rent units from the decennial census. The change in supply is a weighted share of the total change between the two censuses. The weight is determined by

the number of building permits issued, lagged by one year, and the number of units demolished.[28] Monthly building permit data are used, by month, back to 1996; prior to 1996, annual building permit data are used. Monthly permit data are obtained from annual data by assuming equal shares in each month. Demand is derived from the annual vacancy rates and the computed supply, using the relation $vr_t = 1 - (d_t / s_t)$. The vacancy rate is assumed to be constant through the year. Cost is the construction cost index available in table 21.08 in the State of Hawaii databook. Income is the state household income estimates provided by the Census Bureau.[29]

Comparison area estimation using specific areas

We presented models of Mililani rents in table 6, using composite market rents that combined rents from several areas. To check the sensitivity of the results to the definition of the control area, we modeled Mililani rents as a function of rents in specific areas. Table 13 lists the results of several specifications.[30] Columns 1 through 3 use three different areas as the controls. The results are very similar. In each case, the signs of the coefficients on the allowance and the allowance interacted with the military as a percent of population are unchanged. The estimated elasticities and the associated standard areas are about the same.

Columns 4 and 5 list the results of models of two-bedroom apartment rents in Mililani. Again, the results are qualitatively the same, and the implied elasticity is similar to that reported in table 6. Column 6 lists

28. Simply adding the lagged number of unit permits issued and subtracting demolitions to the 1990 Census results in a significant overestimate of units by 2000. Thus, we used the share of the actual increase between the 1990 census and 2000 proportional to the share of permits and demolitions.

29. For small areas, the Census provides 2-year moving averages. The income used in the estimation is taken as the Census estimate from the first year the household income is included in the Census estimate. For example, the estimated 2-year moving average income for 1998–1999 is taken as the 1999 household income in the model.

30. All regressions control for first-order autocorrelation.

the results of a model of two-bedroom townhouses, which are also similar to table 6.

Overall, the model appears robust to different definitions of the control area.

Table 13. Alternative models of Mililani rents

Modeled rent Control rent	Mililani composite Makiki composite (1)	Mililani composite East Oahu composite (2)	Mililani composite UH/Manoa composite (3)	Mililani two-bedroom apartment Makiki composite (4)	Mililani two-bedroom apartment East Oahu composite (5)	Mililani two-bedroom townhouse East Oahu composite (6)
Control rent	0.336	0.119	0.316	0.107	0.083	0.068
	(2.80)**	(2.69)**	(3.37)**	(1.17)	(2.48)*	(2.00)*
Allowance	-0.421	-0.454	-0.349	-0.502	-0.523	-0.471
	(1.19)	(1.24)	(0.95)	(1.65)	(1.88)	(1.65)
Allowance* MilitaryPop%	11.705	12.606	9.375	17.786	18.023	14.842
	(2.14)*	(2.24)*	(1.63)	(3.82)**	(4.22)**	(3.38)**
Vacancy rate	0.709	1.006	2.605	0.607	1.202	4.256
	(0.14)	(0.19)	(0.49)	(0.14)	(0.30)	(1.02)
Per-capita income	0.036	0.035	0.027	-0.006	-0.007	0.011
	(1.45)	(1.37)	(1.06)	(0.29)	(0.35)	(0.56)
Population	0.000	0.001	0.002	0.001	0.002	0.003
	(0.12)	(0.71)	(1.15)	(1.12)	(1.66)	(2.56)*
Unemployment rate	-6.491	-3.880	-12.375	-17.699	-13.866	-10.883
	(0.87)	(0.49)	(1.65)	(2.84)**	(2.29)*	(1.75)
Date	-0.092	-0.891	-0.891	-0.863	-1.005	-1.454
	(0.12)	(1.33)	(1.33)	(1.37)	(1.97)	(2.77)**
Constant	-480.599	-763.093	-1,224.175	-148.381	-489.690	-1,608.560
	(0.40)	(0.60)	(0.94)	(0.14)	(0.51)	(1.62)
Observations	88	88	88	88	88	88
R-squared	0.96	0.96	0.97	0.97	0.98	0.98
Implied elasticity	.094	.10	.06	.36	.35	.21
Standard error for elasticity	.23	.24	.27	.08	.08	.14

Estimation of a two-equation simultaneous system

The results presented in the body of the paper include the supply equation in the simultaneous system, to account for the potential correlation of errors, though supply in a given period is predetermined. An alternative is to assume that there is no correlation in the errors, and to estimate the demand and price equations as a simultaneous system and the supply equation independently. Larger sample sizes are possible when this approach is taken, because the three-stage model requires that all variables be present for all three equations. In this case, variables that are missing observations that affect only the supply equation can be included in the simultaneous equation and vice versa. However, for consistency, we restrict the sample to the same observations used in the three-equation model. (Estimates without this restriction on the sample are very similar.) The results of this estimation are presented in table 14. These results are very similar to the estimation of the three-equation simultaneous system, presented in table 8.

Estimation of simultaneous model using annual data

Monthly estimation uses the price data fully, but requires strong assumptions to create monthly observations for the remaining variables. An alternative is to aggregate the monthly rent data into annual data, and estimate the system with yearly observations. The use of annual data necessitates using a 1-year lag on rent rather than a 1-month lag in the equation for rent. The results are presented in Table 15. The income elasticity of demand falls from .24 in the monthly estimation to .12 in the annual estimation. The price elasticity of supply is much higher in this model also.

The reduced form estimates using annual data are presented in table 16.

Table 14. Simultaneous equations model of Oahu rent and demand; supply determined independently[a]

Ln(supply) (estimated independently)		Ln(demand)		Ln(rent)	
Ln(supply)	.990	Ln(rent)	-.172	Ln(rent)	.838
(12 month lag)	(20.45)***		(9.40)***	(1 month lag)	(15.30)***
Ln(rent)	.013	Ln(household	.264	Ln(vacancies)	-.097
(12 month lag)	(2.55)**	income)	(7.41)***		(2.17)**
Ln(cost)	-.020				
(12 month lag)	(3.99)***				
Constant	.136	Constant	10.149	Constant	1.974
	(0.22)		(36.40)***		(2.79)***
Observations	66		66		66
R-squared	.99		.55		.88

a. Absolute value of t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 15. Simultaneous equations model of Oahu rent and demand using annual data[a]

Ln(supply)		Ln(demand)		Ln(rent)	
Ln(supply)	1.578	Ln(rent)	-.084	Ln(rent)	.741
(1-year lag)	(15.27)***		(3.20)***	(1 year lag)	(10.95)***
Ln(rent)	.079	Ln(household	.120	Ln(vacancies)	-.144
(1-year lag)	(6.54)***	income)	(1.84)*		(3.46)***
Ln(cost)	.013				
(1-year lag)	(3.26)***				
Constant	-7.441	Constant	11.081	Constant	3.022
	(5.73)***		(19.33)***		(3.83)***
Observations	9		9		9
R-squared	.999		.563		.978

a. Absolute value of t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 16. Reduced form rental market model with annual data[a]

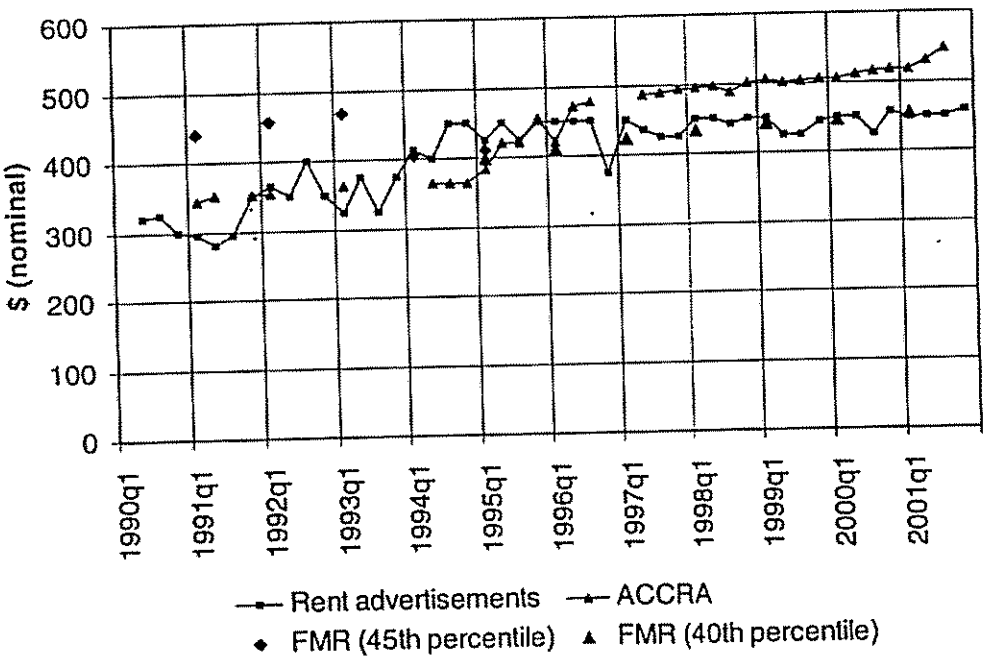
Variable	Supply endogenous	Supply exogenous
Ln(rent)	-1.385	-0.822
(1-year lag)	(2.27)*	(1.09)
Ln(cost)	0.126	0.103
(1-year lag)	(0.58)	(0.49)
Ln(household	0.371	0.505
income)	(1.63)	(2.07)
Ln(supply)	-18.843	-6.024
(1-year lag)	(3.78)**	(0.51)
Ln(supply)		-8.345
		(1.19)
Constant	234.968	176.827
	(3.86)**	(2.33)
Observations	9	9
R-squared	1.00	1.00

a. Absolute value of t-statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix B: Comparison of Clarksville data

Figure 22 charts differences in the three sources of data on rents in Clarksville. All three sources show fairly stable prices from the mid 1990s through 2000, although in 2001, the ACCRA-reported rents rise more than the others. The FMR rents and the advertised rents are almost the same in this time period. Because FMR is a projection, in a stable market, we would expect advertised rents and the FMR to be similar. The higher ACCRA-reported rents could be a selection of the higher end market; the similarity of the trends is more important than the difference in values. Tbe advertising data show greater volatility, and an earlier rise in the 1994 time frame than the ACCRA data. While advertised rents rose, FMR rents fell. Thus, the three sources present slightly different details, but also some strong similarities.

Figure 22. Clarksville advertised rents, FMR and ACCRA reported rents



References

[1] Gary L. Wick. *An Analysis of the Effects of Military Housing Allowances and Other Military Related Factors on Private Sector Rental Housing Prices*, Dec 1996, Naval Postgraduate School, Monterey, CA

[2] General Accounting Office. *Military Housing Allowances: Housing Allowances Provided Military Members in the United States*, GAO/NSAID-86-78BR, Jun 1986

[3] Frank Camm. *Housing Demand and Department of Defense Policy on Housing Allowances*, Rand, R-3865-FMP, Sep 1990

[4] Ira S. Lowry, ed. *Experimenting with Housing Allowances: The Final Report of the Housing Assistance Supply Experiment*, Rand Corporation, 1983

[5] Ira S. Lowry. *Experimenting with Housing Allowances: Executive Summary*, Rand R-2880-HUD, Apr 1982

[6] Julia L. Hansen, John P. Formby, and W. James Smith. "Estimating the Income Elasticity of Demand for Housing: A Comparison of Traditional and Lorenz-Concentration Methodologies." *Journal of Housing Economics*, 7, 1998, pp 328-342

[7] G. Donald Jud, John D. Benjamin, and G. Stacy Sirmans, "What Do We Know about Apartments and Their Markets." *Journal of Real Estate Research*, 11(3), 1996, pp 243-257

[8] Eric A. Hanushek and John M. Quigley. "What is the Price Elasticity of Housing Demand." *Review of Economics and Statistics*, 62(3), Aug 1980, pp 449-454

[9] Peter Bernstein and George Tolley. "The Economic Impact of Reducing On-Base Naval Housing." *Contemporary Economic Policy*, 18(3), Jul 2000, pp. 345-358

[10] F. M. Scherer and David Ross. *Industrial Market Structure and Economic Performance.* Boston: Houghton Mifflin, 1990

[11] State of Hawaii, Department of Business, Economic Development & Tourism. *The State of Hawaii Data Book 2000,* Honolulu, 2001

[12] Robert D. Niehaus, Inc. *2000 Oahu Family Housing Market Analysis, Final Report, Abridged.* Santa Barbara, CA, Jan 2001

[13] Prudential Locations. *Oahu Military Housing Market Analysis,* 30 Mar 1997

[14] *A Guide to Hawaii's Residential Leasehold,* at http://www.osman1.com/leashold.html, accessed May 6, 2002

[15] William H. Greene. *Econometric Analysis, 3rd ed.*, Upper Saddle River, New Jersey: Prentice-Hall, Inc., 1997

[16] John D. Benjamin, G. Donald Jud, and Daniel T. Winkler. "A Simultaneous Model and Empirical Test of the Demand and Supply of Retail Space." *Jouranl of Real Estate Research,* 16(1), 1998, pp 1-13

[17] Robert D. Niehaus, Inc. *2000 Fort Campbell Family Housing Market Analysis, Final Report, Preliminary Report.* Santa Barbara, CA, Mar 2001

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